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Foundations of the Goldfield Consolidated Mill

About 7000 Cubic Yards of Concrete in Place Cost $11.82 per Yard, The Average Mixture Being 1— 3.6 — 3.67. Labor Cost High

BY PERCY E. BARBOUR*

The new 600-ton mill of the Goldfield Consolidated Mines Company at Goldfield, Nev., which has recently been put in operation, presents an example in the matter of concrete foundations in metallurgical mill construction, that is notable in several ways. The size of the job is not the least interesting of the data to be given in this connection. In excavating for the mill foundations, 28,325 cu.yd. of rock were blasted. Nearly 7000 cu.yd. of concrete have been placed, data on 6182 yd. of which are here given. The steel-mill building weighs 1,453,304 lb. and the machinery and equipment resting on the concrete will weigh as much more, not including the pulp in process in the tank, which will be 600 tons of ore per day with treatment water amounting to 6 tons of water to the ton of ore. In addition to this, the battery ore bins when full hold 4000 tons of ore.

THE GOLDFIELD CONSOLIDATED MILL, ABOUT TWO MILES NORTH OF GOLDFIELD, NEV.

MILLSITE, SHOWING CONCRETE PLANT AND GRAVITY TRAM—GOLDFIELD CONSOLIDATED MINES COMPANY

The equipment of the mill and the plan of treatment were described in the JOURNAL of Sept. 5, 1908. When the design of the mill was in hand, it was estimated that the concrete would cost $12 per yd. in place. Detailed cost sheets for 6182.7 yd. show an actual total average cost of $11.82 per yd. of concrete in place, which is certainly a lasting compliment to J. H. MacKenzie, general manager, and to J. B. Fleming, the mechanical engineer, under whom the original design was made.

CONCRETE PLANT

The mill is of the usual terraced construction and is situated about 2 miles

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north of Goldfield. At the top of the mill was the plant for crushing the rock and making the concrete. This plant consisted of a No. 3D Gates gyratory crusher, set to give a 2¼-in. product. From this crusher the rock was carried by a steel-flight bucket elevator to a 48x84-in. revolvign screen which ran 21 r.p.m., and was set with a pitch of 1¼ in. per foot. The oversize from this screen was discharged directly into a storage bin below. The product through the screen was passed through a set of 26x15-in. style A Allis-Chalmers rolls set directly below the screen. These rolls were set for a ½-in. product. This fine product, much of which would pass a 16-mesh screen, was used for sand in the concrete and was discharged from the rolls into a second compartment of the storage bin below. The crushing plant was driven by a 75-h.p., 3-phase, 440-volt, 60-cycle, Bullock motor.

The rock to be crushed was hauled to the top of the hill by two-and four-horse teams and was dumped on a platform level with the hopper of the gyratory crusher, into which it was shoveled by hand. The rock and sand were drawn from the storage bin through standard rack-and-pinion ore gates into Sterling concrete buggies on the mixing platform, which was about 10 ft. wide From these buggies it was dumped into a No 2 Ransome mixer of ½ yd. capacity. This mixer was driven by a separate 10-h.p. motor. Cement was brought to the mixing platform from the storehouse by a short semi-gravity inclined tramway about 175 ft. long, operated by a small electric hoist. Concrete buggies receiving the mixture dumped it into a short chute leading to a skip car underneath the platform. This skip was one of two on an inclined gravity tramway which lowered the concrete to the wall that was to be poured.

Rock and Sand

The rock for the concrete was quarried about half a mile from the millsite on company ground and hence cost nothing except for the quarrying, hauling and crushing. The larger proportion of the sand used was a product from the crushing of this rock. The rest of the sand was dug from various deposits found in the adjacent desert and was also free. Little good sand can be found for concrete purposes near Goldfield, as it contains such a large proportion of volcanic ash that it would make poor concrete. All of the pit sand used was dumped into the big crusher, although only rarely were there any rocks or pebbles large enough to be broken. It was then elevated to the screen, and thence to the rolls and thus brought to size.

Hauling the rock from the quarry to the concrete plant was done by contract teams. A two-horse team was paid $8.50 per day and hauled 1 yd. at a load. A four-horse team was paid $14 per day and hauled 3 yd. at a load. In either case eight loads were required as a day's work. The total amount of rock quarried was 6267.4 yd., of which there was used in the concrete 3842 yd. of crushed rock, the balance being used as rock sand. In the lower portion of three of the larger walls, large coarse rocks were embedded in the concrete.

Foundations

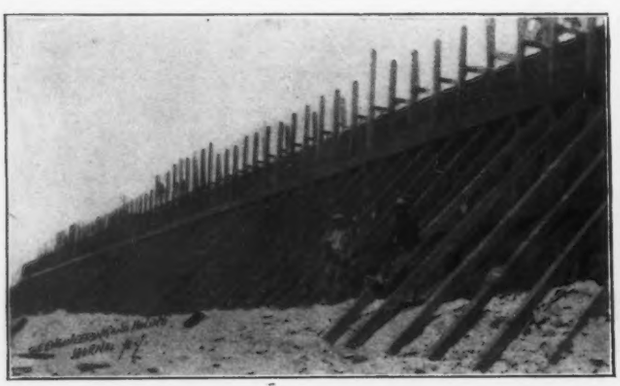
The concrete used in the foundations required 1045.7 cu.yd. of cement, the average mixture of cement, sand and rock being 1—3.6—3.67 respectively. The mixture used in some of the individual walls may be of interest. For the low retaining wall *A*, the mixture was 1—2.7—3.96; for the battery block *D*, it was 1—3.14—3.14; the mixture 1—4—4 was used for the sampling mill and mill foundations *B* and *C*, retaining walls *I*, *J*, *K*, foundation piers *L* and for certain of the tank foundations. The mixture for the tube mill foundations was 1—3.67—3.67, being almost identical with the average mixture of all concrete used.

The gravity tram was located on the center line of the mill, the shortest wall of which was 210 ft. long and the longest 294 ft. There were twelve walls and rows of foundation piers exclusive of the piers for machinery and tanks. The difference in elevation between the top of the first and the last foundations is about 132 ft., and the horizontal distance between the two is 395 feet.

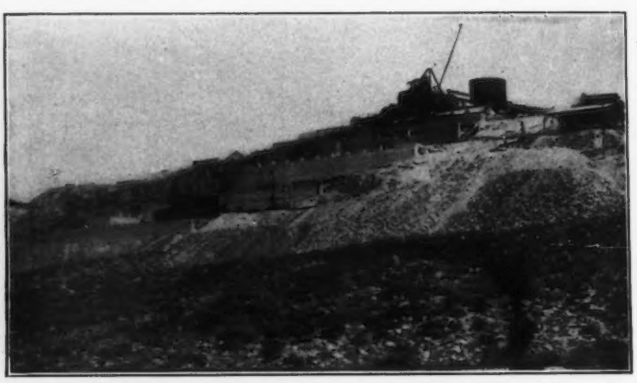
The retaining walls and piers for building columns are designated by letters beginning *A*, *E*, *F*, etc., to and including *L*. *B* and *C* are rows of piers for intermediate columns under the ore bins; *D* is the concrete mortar block. All the retaining walls and foundations which carry building columns are 2 ft. wide on top; the back of the wall is in each case vertical and the front wall has a batter of 1½ in. per foot.

Beginning with wall *E*, all walls are reinforced with Johnson reinforcing bars of ¾-in. corrugated steel. Wall *A* is a plain low retaining wall; *B* and *C*, as already stated, were for ore-bin columns. The sampling-mill foundations were plain low walls and joined the main mill at the south end of the ore bins. The battery block *D* is an interesting block of concrete construction. It is 192 ft. 10 in. long by 6 ft. wide on top and has a cross-sectional area of 96 sq.ft. Instead of anchor bolts set solidly in the concrete mass, rods were used for holding down bolts and subsequently inserted in 2-in. pipes which were set in the concrete in the usual way. Wide and deep apertures were left for the nuts and washers on the lower end. The thin webs between these apertures are each reinforced with two ¾-in. steel bars 3 ft. long. Wall *G* when constructed had a form for its face only. The back wall was built up of dry rubble as an experiment, which was not so satisfactory in saving of expense as to prompt a repetition. Piers *L* were building-column piers, 2 ft. square on top with the regular batter and from 12 in. to 2 ft. deep, to reach to bedrock.

The tube-mill foundations were the usual piers for the pillow blocks for the tube mills and the necessary main line shafting for driving them and are very heavy on account of the severe service imposed. The foundations for tanks consisted of straight walls 12 in. wide on top, both sides having a batter of 1½ in. per ft., and were from 12 in. to 4 ft. high depending on the nature of the



FORM FOR RETAINING WALL F



CONCRETE FOUNDATIONS—GOLDFIELD CONSOLIDATED MILL

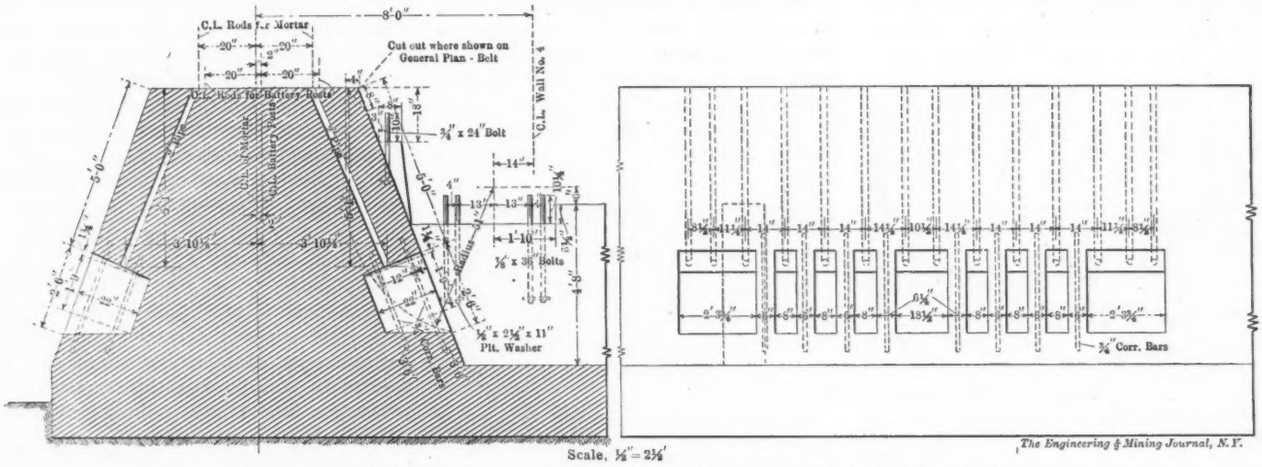
ground. Their only purpose was to furnish level, uniform supports for the timbers which were placed 24 in. apart, immediately under the wooden-tank bottoms.

Costs

The cost per yard of concrete in place for the retaining walls varied from $10.05 to $12.27, the latter figure being for the retaining wall *F* and the former for the retaining walls *I* and *J*. The battery block *D*, comprising 810 cu.yd. of concrete in place, cost $11.60 per cu.yd. The tube-mill foundations cost $12.65 per yd., and other foundations range from this figure up to as high as $19.31 for some of the smaller blocks. The total average cost per yard of concrete in place was $11.82, and is divided approximately as shown in the accompanying table. The item of reinforcing appears too low per yard in this table because it is apportioned over a somewhat larger number of yards than were actually reinforced. The proper cost per yard reinforced is 48 cents.

COST OF CONCRETE IN PLACE

Cement		$5.03
Rock		1.06
Rock-sand	$0.67	
Pit-sand	0.45	
Sand (total cost)		1.12
Labor		1.32
Forms		2.76
Engineering and Superintendence		0.15
Reinforcing		0.38
Total cost per yard		$11.82


C.L. Rods for Mortar
Cut out where shown on General Plan - Belt
C.L. Wall No. 4
C.L. Rods for Battery Roofs
C.L. of Battery Walls
¾" x 24" Bolts
⅛ x 3½" Bolts
½" x 2½" x 11" Pit. Washer
¾" Corr. Bars
Scale, ½"=2½'
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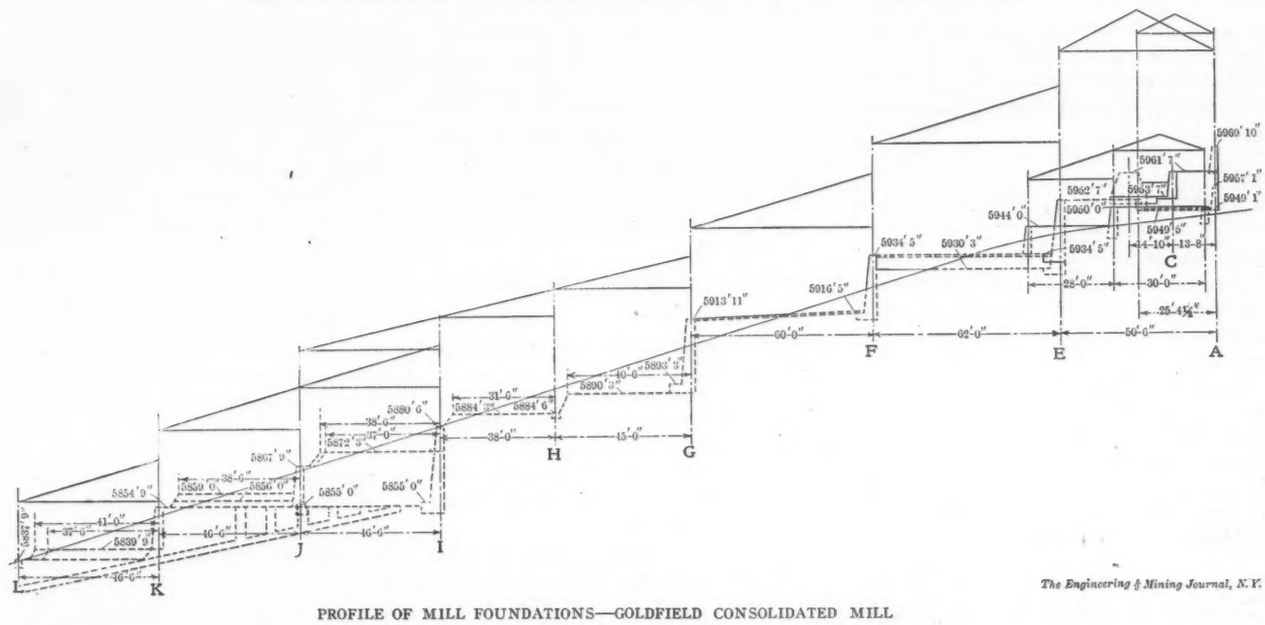
SECTION AND ELEVATION OF CONCRETE BATTERY BLOCK—GOLDFIELD CONSOLIDATED MILL



PROFILE OF MILL FOUNDATIONS—GOLDFIELD CONSOLIDATED MILL

High Labor Expense

The scale of wages for this job was high, as everything is in Goldfield, and was approximately as follows per 8-hour shift:

Carpenter foremen, $6; carpenters, $5; carpenter helpers, $4; concrete foremen, $5; concrete laborers, $3.50.

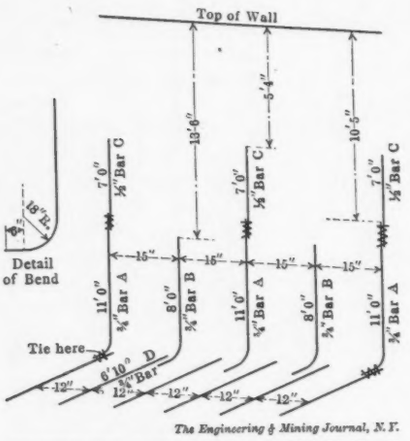
Under labor the expense includes a uniform charge of 25c. per yd. for all work, to cover the drawing of the crushed material from the bins, wheeling across the short platform, dumping into mixers, addition of cement and water, and running the mixer. The average labor cost for taking the concrete from the gravity tram cars to the forms was 35c. per yd., but varied between 25 and 85c., the latter figure applying on the small foundation piers *L*. The longest wall was 294 ft., making the wheel from the gravity tram cars 147 ft. Tamping cost varied between 31c. and $1.20, the average expense being 72c. per yd. of concrete laid. With the high cost of Goldfield labor, these labor items are all very high and it should be noted do not include any labor in connection with the building and tearing down of the forms.

Preparing the Forms

In building forms for the foundations some of the lumber was used several times, and on the average it could be used three times before destruction. The forms were made of 2-in. planks; the ties were 2x4 in. and the braces were of 4x4-, 4x6- and 6x6-in. timbers. The forms for the higher walls were tied together by telegraph wire, twisted between the braces. All foundations bolts were hung in the usual way from cleats which

were wired at the bottom to keep them in the proper position.

The charge for engineering and superintendence includes the total time of a concrete superintendent, a civil engineer running a transit and a chainman, but does not include designing or drafting office expense. Power cost for running the crushing and mixing machinery was extremely low, owing to the efficient system of purchase and distribution of electricity by the company. The total average cost per horsepower-hour was $0.009. The power was secured from the Nevada-California Power Company, being brought from Bishop, Cal., 150 miles west of Goldfield.



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REINFORCING BARS FOR RETAINING WALL F

British Steel Production

As already noted, the production of pig iron in Great Britain in 1908 was 9,289,840 long tons; being a decrease, as compared with 1907, of 634,016 tons, or 6.4 per cent.

The British Iron Trade Association has now reported the production of steel for 1908, which shows a greater comparative decrease than that of pig iron, the total decline having been 1,227,106 tons, or 18.8 per cent. The make of steel for two years has been, in long tons:

	1907		1908	
	Tons.	PerCt.	Tons.	PerCt.
Bessemer	1,859,259	28.5	1,478,539	27.9
Open-hearth	4,663,489	71.5	3,817,103	72.1
Total	6,522,748	100.0	5,295,642	100.0

The division, according to acid and basic steel was as follows in 1908:

	Acid.	Basic.	Total.
Bessemer	906,466	572,073	1,478,539
Open-hearth	2,578,840	1,238,263	3,817,103
Total	3,485,306	1,810,336	5,295,642
Total, 1907	4,665,095	1,857,653	6,522,748

The increased proportion of basic steel last year was due to the fact that the decrease in basic open-hearth production was very much smaller than in any other kind.

The production of finished material of all forms from open-hearth ingots is reported at 3,804,129 tons. This would indicate that considerable stocks of ingots must have been carried over from the previous year, or that some foreign material was used. The latter is more probable, as Great Britain was a large importer of billets and blooms last year, chiefly from Germany. For some periods of the year British mills could buy billets, forced on the market by the German Steel Syndicate, for less than it cost to make them in their own works.

The make of finished material from bessemer steel is not fully reported, bars, forgings and some other important items being omitted. More than half the bessemer steel was used in making rails. The total production of rails for two years was, in long tons:

	1907.	1908.	Changes
Bessemer steel	832,576	715,407	D. 117,169
Open-hearth	79,532	192,525	I. 112,993
Total	912,108	907,932	D. 4,176

The remarkable point here is the great increase in open-hearth steel rails, which points to a movement in their favor similar to that which has been going on in this country.

The production of wrought or puddled iron was in direct opposition to that of steel. For several years this output has been declining, but in 1908 it showed a large gain; advancing from 975,083 tons in 1907 to 1,168,115 tons in 1908, an increase of 193,032 tons, or 19.8 per cent. The reason for this change is not altogether clear. The total production of bars, plates and all other finished forms from wrought iron last year was 1,050,772 tons.

Behavior of Tellurium in Assaying

Previous writers have been in substantial agreement regarding the use of a basic slag in crucible assays of telluride ores and the conducting of the fusion slowly at moderate temperatures. The behavior of tellurium in assaying has been investigated by S. W. Smith (*Inst. Min. and Met.*, Bull. 44).

The effect of litharge on tellurium was investigated in various ways. Lead buttons containing lead, 6 parts; gold, 1 part tellurium 1.5 parts; were fused or soaked under litharge at a temperature of about 800 deg. C. for 15 min. and then cupelled. The litharge was black, lustrous and opaque. The lead button when cupelled yielded 96 per cent. of the gold. Duplicates of these fusions were left in the furnace and the temperature raised to 1000 to 1100 deg. C. for another 15 min. and on cupelling the recovery was only 94 per cent. The slag was dark, red and glassy; evidently some of the tellurium had been reduced as indicated by the gold recovery. Again, equal portions of pure lead were fused separately with samples of the opaque and the glassy slags containing equal quantities of tellurium, with the result that the lead from the fusion with the opaque slag showed far more tellurium than the other. This would seem to indicate that a portion of the oxidized tellurium is reduced again when the temperature is raised.

A lead button of the same composition as previously described was dropped into litharge to which a little sand had been added, and which had been kept at a temperature of 1000 to 1100 deg. C. for 30 min. and allowed to remain in the furnace for 10 or 15 min. more. The weight of the button was unchanged and it was completely absorbed on cupellation. The slag was straw color and gave no indications of tellurium except for a slight reddish cloud, near the button. A repetition of the experiment, except that after the formation of the silicates the temperature was lowered and maintained at a low point after the introduction of the button, gave similar results. After the formation of silicates there is practically very little tendency for the tellurium to oxidize. An examination of the slags seemed to indicate that the reaction between the litharge and tellurium is represented by the equation:

$$2\,PbO + Te = Pb_2O + TeO,$$

and that the reverse of this reaction takes place at higher temperatures.

The effect of scorifaction, unless the operation is carried out at a moderately low temperature, is to concentrate the tellurium in the button. The most effective way to remove tellurium is to "soak" the button under litharge either in a scorifier or crucible at low temperature.

The effect of tellurium in a lead button containing gold and silver is to weaken the surface tension of the molten metal during cupellation. This effect of tellurium, assisting the general tendency of the film of litharge in the same direction, results in the tendency of the molten metal to "wet" the sides of the cupel. If the amount of lead is small in proportion to the silver, gold and tellurium, small portions of metal become detached and either pass into the cupel or leave minute beads.

Lead is more readily oxidizable than tellurium, especially at high temperatures; if sufficient tellurium remains toward the end of the cupellation, complete absorption may take place, or in other words. complete absorption and subdivision are the result of insufficient lead. The tendency to become "wetted" is greater with bone-ash cupels than with patent cupels.

The presence of silver protects gold by acting as a diluent during the cupellation of buttons containing tellurium. The absorption loss due to the presence of tellurium is a function of the temperature of cupellation. An excellent bibliography is given in connection with the paper.

The Panel System as Applied to Metal Mining

The Conditions to Be Met Were a Wide Orebody with Horizontal and Vertical Jointings, and a Weak and Treacherous Hanging-wall

BY H. E. WEST*

In metalliferous mining the efficiency and economy of extraction is largely governed by the physical characteristics of the deposit. Usually ore deposits are bounded by recognizable walls, although one, and possibly both, may be lacking in definition. Perhaps of all factors that determine the method of extraction, the character of the walls and the width of the deposit are preëminently the most important. The nature of the walls, especially that of the hanging, is an essential consideration. The character of the employees has to be considered, especially when dealing with unskilled native races.

Much depends on the character of the orebody, whether it is hard or soft, homogeneous or broken with slips or faults, or even blocky, with well developed joints or bedding planes.

As an example of the evolution of a system suitable under certain conditions, a deposit such as is illustrated in the accompanying sketches may be considered. Fig. 1 shows the shape of the deposit, together with the segregation of the several grades of ore. It will be seen that roughly the orebody may be divided into three classes: (a) Low-grade; (b) medium-grade ore; (c) rich ore. The richest ore lies against the hanging-wall, the lower grades toward the footwall.

The hanging-wall is composed of a crushed slicken-sided shale, possessing no element of stability; indeed, when at all laden with water, it behaves much like sand or thickened mud. In this shale occur ill-defined stringers, that are, however, very rich. The ore is usually from medium to hard, varying from a silica gangue on the hanging side to a barite gangue toward the footwall. The ore is stoped to a width of about 50 ft. The deposit is contiguous to the contact of an igneous and sedimentary rock, the ore being a replacement of the latter. The dip is about 70 deg. southerly. The particularly unfavorable feature of the orebody lies in the almost horizontal joints, that probably represent the bedding planes, together with a vertical jointing connecting same. The "horizontal" joints are actually inclined upward toward the slate hanging. The footwall is a hard clastic rock, considerably softened by water flowage along the line of contact.

The conditions here presented are a wide deposit, with an extremely weak and treacherous hanging-wall; the roof of the orebody has seams and joints and, moreover, is considerably faulted after deposition. The eastern end is more shattered and considerably weaker than the western. A very considerable water circulation exists along the slate hanging and, during spring, within the orebody. The one markedly favorable feature is the firm footwall and ore toward that wall.

First Method of Working

The initial method of opening up this deposit was by a center drive, cribbing and filling with waste rock. On working toward and approaching the hanging-wall, the inclined jointing or bedding planes caused the ore to break higher than the normal stope and thus expose an undue surface of the weak hanging. The consequence was that the wall ran and the roof settled, often in large masses. The hanging-wall streak was temporarily left to support the weak wall. It was found a matter of considerable difficulty to extract such ore afterward; in fact, much of it never was recovered.

On the sill stope being taken out, cribbed and filled, and on the second stope being opened up for stoping similarly, still greater falls were encountered. The settling of the hanging, moreover, was so severe that the cribs and level sets were thrown over and the latter fractured so that eventually the level had to be abandoned.

A little reflection showed the unfavorable and also certain favorable and char-

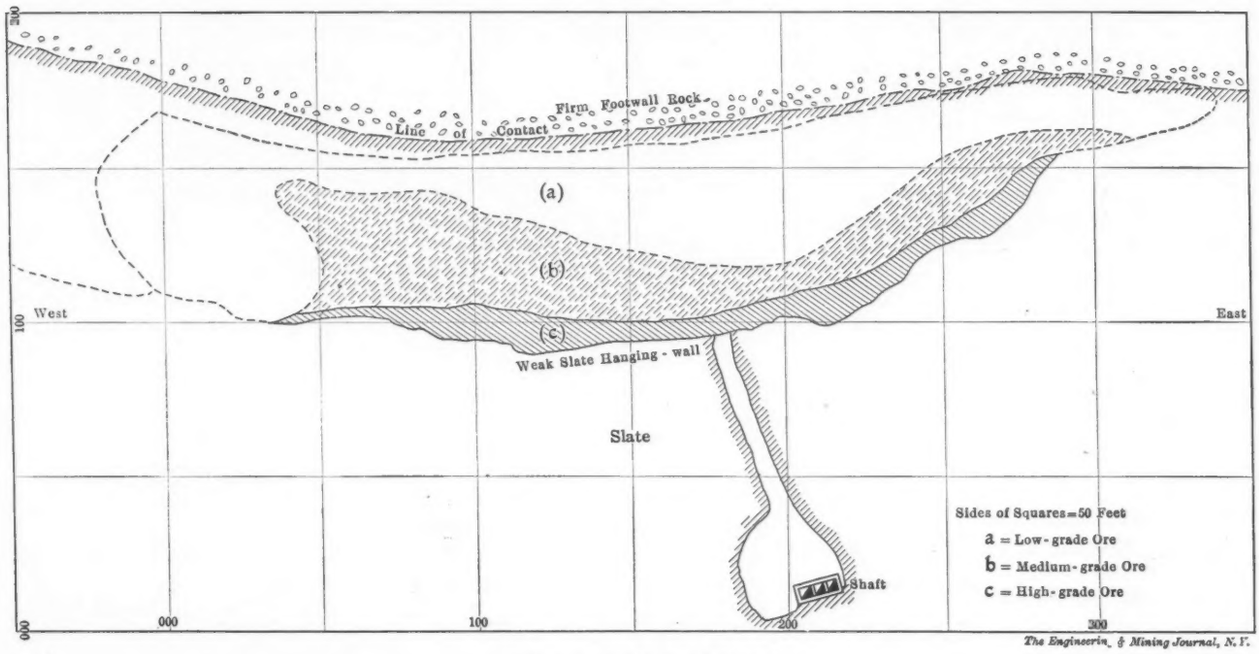


FIG. 1. TYPICAL ORE SHOOT

*Mining engineer, El Oro, Mexico.

acteristic features of the deposit, which evidently had to be taken into account in evolving an efficient method of extraction. It was evident that stoping *toward* the hanging-wall encountered peculiar difficulties. It was also evident that but little of the hanging could be exposed, unsupported with timber, at one time. It was equally clear that were any considerable area of roof left without support, a serious fall might be expected, which had the particular disadvantage of spreading upward and proving troublesome in each succeeding stope. To maintain a center drive open by any system of timbering was impracticable. Masonry was inadvisable, and probably would have shared a similar fate. Moreover, a central drive was unnecessary, unhandy for tramming, and unfavorable for the maintenance of chutes.

The Panel System

Clearly the first thing to do was to open up a rock drift along the contact, where the ground was favorable, and, moreover, rendered sufficient support to maintain such drift permanently. From the rock-drift crosscuts were driven through the deposit at 50-ft. intervals, until the hanging-wall was reached. The orebody was thus cut up into panels of about 45 ft., in width. The next operation was to connect the several crosscuts by running a small drift in the slate, taking out what stringers might be encountered, timbering this drift with light sets, and filling with, preferably, large rock. Thus a solid bulkhead was erected against the soft hanging to the full hight of the stope, maintained at 7 ft., and throughout the length of the shoot. The second slice of about 6 ft. wide, consisting mainly of the rich streak, was extracted, but only through one-half of the panel (about 20 ft.), unless under a firm roof, when the whole width could be safely stoped. The second slice was then filled, and the third extracted and filled, and so on toward the footwall. Thus was the half panel extracted from the hanging- to the footwall. Greater freedom was exercised toward the footwall, owing to the firm character of the roof; still, this liberty could not be abused. Alternate half panels were thus extracted and filled. With the roof packed with filling, together with what sets or cribs were essential, there was little trouble experienced in extracting the remaining half panel in a similar manner. When conditions would permit, such as in the western end, panels could be turned off the lateral and stoped for the full width toward and up to the hanging. In such cases both roof and hanging were firm. Modifications between the two methods were utilized, governed by conditions.

Every stope was carefully carried to 7 ft. in hight, and worked out squarely against the hanging- and footwall. Two horizons could be simultaneously worked and, indeed, such was advisable, so that the production should be continuous and not suffer through all the preparatory blocking-out falling at one period. Usually the ends were maintained in advance of the middle of the stope. Subsequent stopes were opened out and worked in a similar manner, cutting down both lateral and crosscut over the ones below, but leaving the roof of the rock drift intact. Cribbed bins were placed at the mouth of each crosscut and midway between, or about 25 ft. centers. The bins were 3 ft. square within timbers, each alternate chute being provided with a manway. All chutes delivered into the lateral, the mouth of the chute being protected with a grizzly made of 2½-in. angle iron set 6 in. apart; these were firmly spiked to the chute timbers. Winzes were sunk at 50-ft. intervals from the level above and near the footwall for chuting down filling within each panel.

Opening Up the Lower Horizon

Figs. 2 and 3 show how it was proposed to open up a lower horizon, where speed was an important factor. A preliminary, though optional, lateral is here shown in the hanging. From this crosscuts are periodically turned off. These crosscuts serve to show definitely any ore in the slate and also the extent of ore on the footwall, and determine where the footwall lateral may most advantageously be run by connecting such crosscuts. This slate lateral is then filled, as it has served the purpose. The slate, with what ore it may contain, is then extracted against the hanging-wall streak as before, timbered and filled. Stoping then proceeds as shown.

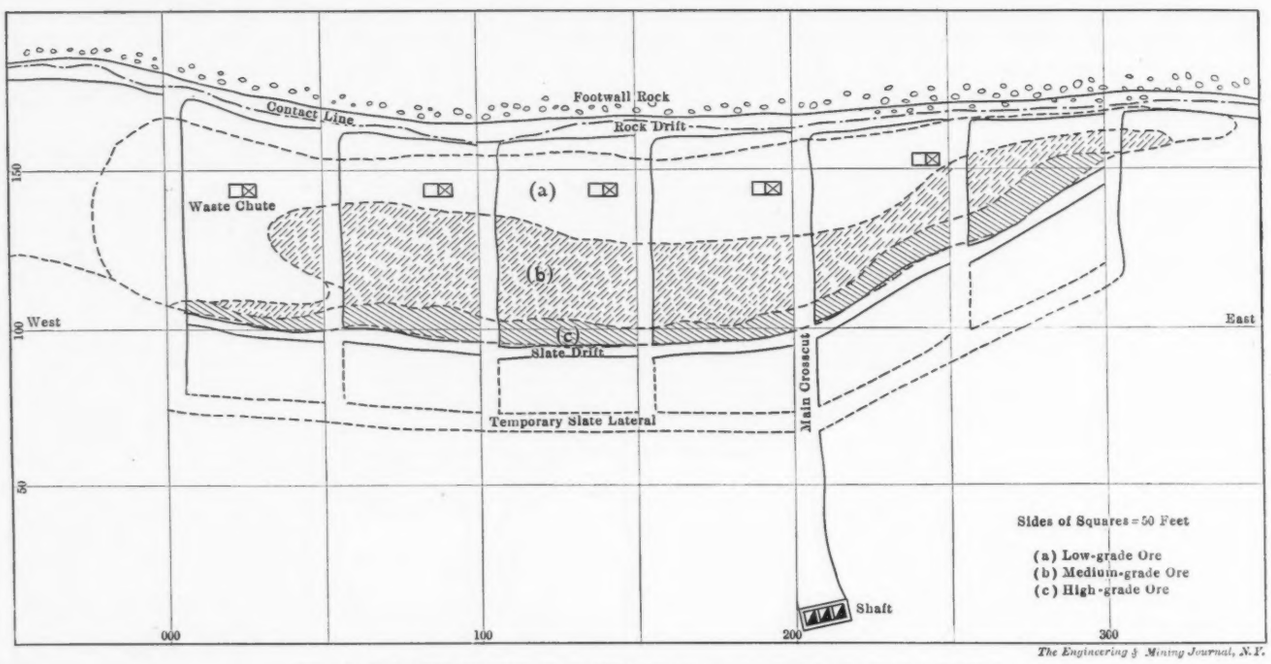


FIG. 2. PROPOSED METHOD OF OPENING UP LEVEL WHERE SPEED WAS A FACTOR

Doubtless much of this preliminary work seems superfluous. It is capable of some modification, as for instance, the preliminary drift may be omitted and the footwall lateral run from the main crosscut and the work expedited from the several winzes sunk. The footwall rock being much harder, considerable more time would be consumed which, in this case, was an element of importance. Again, where the hanging-wall was firm and the roof favorable, the panels could be driven from the lateral and breast-stoped toward the hanging.

It was impracticable to carry forward a wide breast longitudinally as in a solid orebody, or lodes with firm walls. Square

setting, though an admirable method, was impracticable both by reason of a limited timber supply and inefficient labor. Of course, had the shaft been on the footwall, there would have been no need to maintain a tramming road through the deposit.

Features of the System

The essential features of the method, which I call the "panel system," are as follows: (1) The footwall lateral, giving easy access to the deposit and insuring the permanence of the tram road. (2) The cutting up into panels, with waste-filling and ore-discharging facilities in each. (3) The extraction first either of the slate on the hanging, against the rich streak, or the rich streak itself, with the formation of a solid rock-filled bulkhead. (4) The exposure of a small area on the roof, by sectional stoping; and the stoping of half the panel leaving pillars; the supporting of the roof by filling, and subsequently the safe stoping of such pillars. (5) The comparatively large area of stoping ground exposed; the safety of the workmen, as they are never far from a safe lateral or crosscut. (6) The determination of the definition of the deposit, insuring no irregular stringers or branches being overlooked on the hanging and on the footwall, the complete blocking out of all low-grade ore. (7) The manifest facilities for estimating the grade and quantity of the ore, and the maintenance of systematic assay sheets for each stope.

It will be seen that as the hanging-wall streak is of great value, any admixture with fallen slate would occasion considerable loss; especially so as such ore is scarcely distinguished from slate. This is prevented by this panel method and, moreover, a high extraction is secured throughout the deposit.

In addition, the roof is so well secured that any considerable fall is improbable. Consequently, the stopes go up in solid ground, without the inconvenience and expense of spiling or supporting ground that has been allowed to break away overhead. A clean extraction and the keeping of the ground in place is assured. It is imperative to start the sill stope right. To maintain the roof intact at the first stage is to maintain it intact throughout, with the converse equally true.

The timber consumption is moderate, usually confined to small timber, much of which is available for reuse. The ventilation is always good. Filling is supplied with little handling where required, and the ore, with a short shoveling, or wheel, is fed into the chutes, which are readily accessible and at frequent intervals.

On the other hand, there is considerable blocking out to be done, which means expense. This is largely compensated for by the number of working faces open, an especially desirable feature, as often toward the hanging-wall the ore won daily from any particular working face is small.

It may be of interest to add that the panel system is a development of the "pachua" or "lateral-drive" method used in Mexico for wide lodes with soft or hanging-wall, adapted to the peculiar condition caused by a combination of weak hanging and fallen ground at the Yuspensky mine, Siberia. The method was subject to many modifications dependent on condition of the ground. The opening out and stoping by panel was, however, maintained.

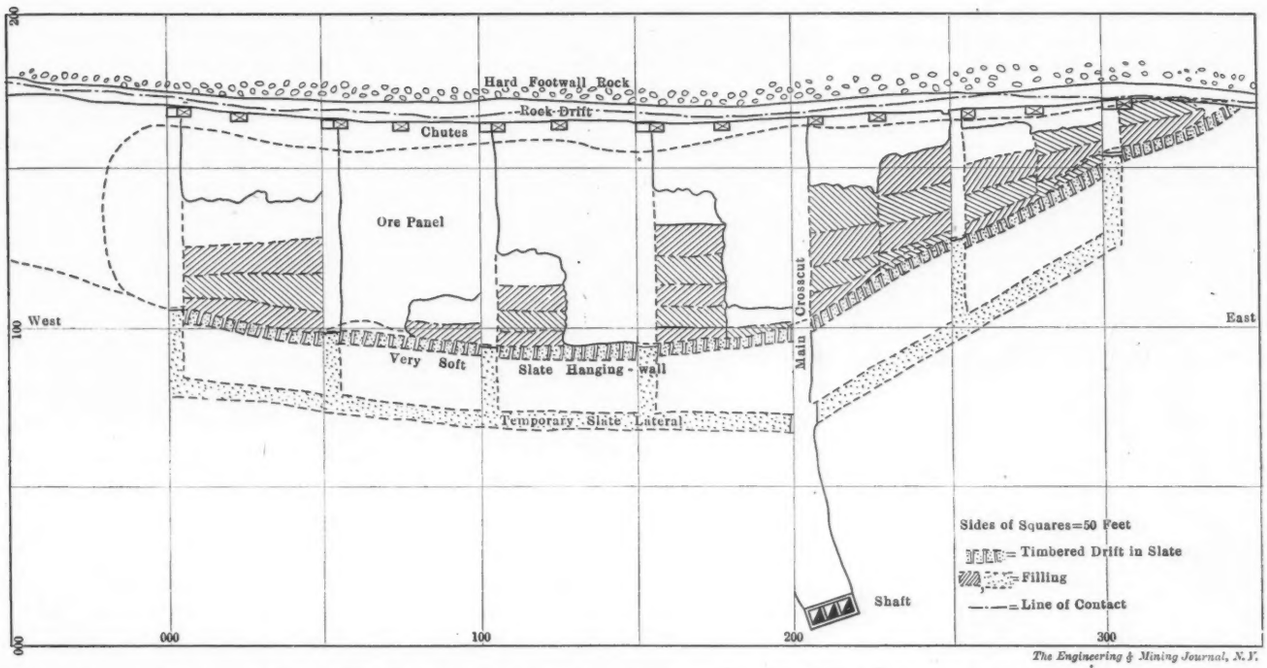


FIG. 3. METHOD OF STOPING WEAK ROOF AND HEAVY HANGING-WALL; "PANEL SYSTEM," SECTION STOPING AND FILLING

A Successful Rhodesian Gold Mine

Special Correspondence

The report just issued by the Globe & Phœnix Gold mine of Rhodesia states that during the year 1908 the ore milled was 75,413 tons at a cost of $6.24 per ton including 96c. for development redemption. Working costs have been reduced 48c. per ton compared with the previous year. The value of the bullion won amounted to £154,555, or $9.84 per ton. After deducting administration charges in London and depreciation the profit for the year amounted to £39,511. Four dividends of 24c. each per share were paid making a total distribution for the year of 20 per cent. on the issued capital of £200,000.

The development of the mine was satisfactory and the ore reserves were increased from 106,155 tons of a value of 11.1 dwt. at the close of 1907 to 144,348 tons of a value of 16 dwt. at the close of 1908. This increase in value and tonnage is due to an improvement in the mine at the 14th and 15th levels.

The main shaft is down 2307 ft. making it probably the deepest mine in Rhodesia. The poor extraction obtained in the mill, referred to by the consulting engineer is due to the presence of antimony. A sorting and jigging plant has been erected, but as the new plant did not start until late in November, no reliable data are yet available as the benefit to be derived therefrom.

An Improved Type of Mine Car Wheel

By J. E. Johnson, Jr.*

One of the principal difficulties in mining operations is to obtain cars so constructed that they will turn around the short curves required without undue friction and at the same time will have wheels and axles that are reasonably durable. The difficulty arises from two circumstances, one of which is that where the wheel base of the car is an appreciable fraction of the radius of the curve, the axles are not coincident with the radial lines of the curve. This makes the flanges bite and runs the rolling friction up very high. The only cure for this trouble is to place the wheels as close together as the radius to be turned may require. But it must be borne in mind always that the stability of the cars lengthwise will be small if the two wheels are close together; and if the car bodies are long the strain on them, being supported only at the center, will be high.

The Greatest Difficulty

The more important difficulty comes from the fact that the outside wheel on a curve has to travel through so much greater distance than the inner, when the radius is short, that the effect in going around the curve with both wheels fast to the axle is as much like a sled as it is like a wheeled vehicle. Just what this can amount to is not generally appreciated. A right angle turn of 20 ft. radius and a gage of only 3 ft. will cause the outside wheel to go 15 per cent. farther than the inside one. So with tight wheel cars there must be a relative skidding of 7½ per cent. of the distance traveled on each wheel; that is, one wheel must skid backward 2.4 ft. and the other forward an equal amount, or in some way there must occur skidding to the amount of 4.8 ft. What this means in pulling a heavily loaded car around a curve is obvious.

The effects of this have been so objectionable that most mine operators have gone to the other extreme and use cars with both wheels loose on the axle, the axle itself not turning. These are now always made with self-oiling hubs and the cost of lubricating such wheels is much less than it formerly was; but wheels of this type are open to an objection inherent in their construction. The wear necessarily makes the hole through the hub constantly larger and the axle constantly smaller. The result is that wheels soon become "drunken" and get so much play that they split frogs, drop through any possible place in the track that is at all wide of gage, and become so utterly objectionable that they have to be replaced with new ones.

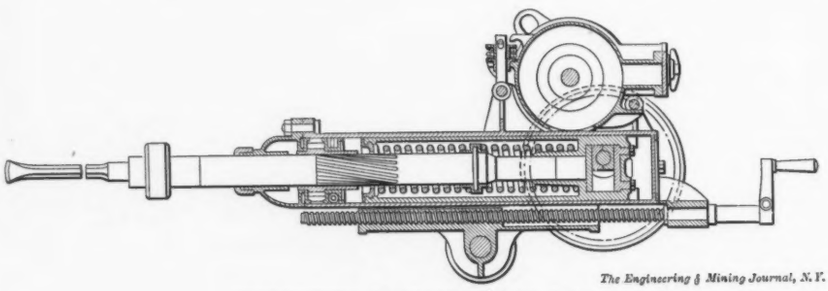
The same condition of drunkenness does not obtain with the tight wheel cars for the reason that the two wheels and the axle in the latter case constitute practically a single structure of so much larger size than the single wheel that an equal amount of play would correspond to much less wear. But far more important than this is the fact that the wear is in only one direction, viz.; upward into the journal boxes, and this wear is always taken up by the weight of the car with the result that a pair of wheels may be worn until the rails have cut through their treads without showing any signs of drunkenness. These facts are quite generally known and understood but this review of them has been given in order to pave the way for what is to follow.

Solution of the Difficulty

The solution of the entire difficulty is absolutely simple and inexpensive. The particular one which I have in mind may or may not be known to the mining public, but considerable missionary work on some of the best wheel manufacturers has been necessary to induce them to make the wheels which avoid the difficulty. It would seem, therefore, that publication again may not be amiss even though the ideas set forth are old to some.

The solution of the difficulty is to make one wheel on each axle tight and one loose and let the axle run in journal boxes. The simplicity of these in construction will astonish those who have never tried it. Journal boxes of the commonest type may be employed and whether they are outside the wheels or inside makes no difference. One wheel is pressed on to its axle just exactly as in ordinary railroad practice. The other wheel may or may not be of the self-oiling type but it is made a running fit on the axle and if not self-oiling, grease cups are provided for lubrication. Any desired arrangement of collar or groove to hold the wheel in its proper relation to the axle may be used. One of the standard modern construction of self-oiling wheel with a key in a groove in the end near the axle inside the hub is about as good as any. The axle should preferably be held to its place by the tight wheel and one collar or by two collars between the journal boxes. The journal boxes are made in one piece if the journals are outside and in two pieces with a cellar if the journal is inside the wheel. The superiority of this construction over the loose wheel construction is so great in practice that it will not be believed by most people until they have made a trial of it; but there is a good reason for this superiority.

All mine tracks are more or less curved but the average radius of curvature is generally not very small. In coal mines, for instance, there are right-angle bends turning off from the main entry but there are hundreds of feet of straight track leading up to these bends and leading into the room beyond them, so that in coal-mining practice probably 80 per cent. of the track is perfectly straight, and if the curvature of the remainder is 20 ft. centers this would make the average radius of curvature 100 ft. This is rather an extreme case but deliberately so taken. If now the gage be 4 ft. one wheel will have to travel 4 per cent. faster than the other on this average radius. With the type of construtction described the tight wheel drives the axle positively.



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CONSTRUCTION OF CRANK IMPACT DRILL

The other wheel in the case assumed would turn relatively to the axle 4 per cent. of its total revolutions. In other words, the relative wear between hub and axle would be exactly one-twenty-fifth of what it would be with two loose wheels. This amount of movement is so small that with a properly constructed hub no objectionable degree of wear will be developed until the tread of the wheel is worn out.

Interesting Points Regarding Trucks

I have bought standard trucks, that is wheels, axles and axle holders, from one of the best manufacturers in the country. These trucks were of the loose-wheel type. The hubs were extra long, an excellent self-oiling arrangement was provided, and everything was done to prevent wear and the consequent drunkenness; but after a short time these wheels began to get loose on their axles and the cars gave trouble by getting off the track. As the cars with their load weighed about three tons, sat very low to the ground, and had a very short wheel base, this was most objectionable. These wheels had been bought on the reputation and guarantee of the manufacturer, rather

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contrary to my own judgment of what was right, but it did look as though the people who made wheels ought to know more about them than the man whose misfortune it was to have them to use, so we bought about 30 or 40 sets of this kind in groups of ten. By the time the last group was put into use it became evident that the inevitable consequences of the loose-wheel construction existed in this maker's design as well as poorer ones, and in spite of conscientious efforts to remedy it. Thereupon inquiries were made among mine-car manufacturers for trucks of the tight-and-loose-wheel type. One manufacturer agreed to make them and at a price about the same as that required for the two loose-wheel construction, the boxes, cellars and babbitt being included in the quotation.

These wheels were put in service, with results that were, from a practical point of view, almost disastrous, because the people who had to use them showed such a great preference to them that they were almost unwilling to continue to use the loose-wheel type. These wheels have now been in use for a period far longer than it took to develop drunkenness in the loose-wheel type, without showing a sign of this or any other defect. They are oiled by waste in the cellar, as in standard railroad practice, with great economy of oil. The loose wheel of course requires to be oiled occasionally but on account of the very small amount of rotation required this is a factor that is almost negligible.

Cost

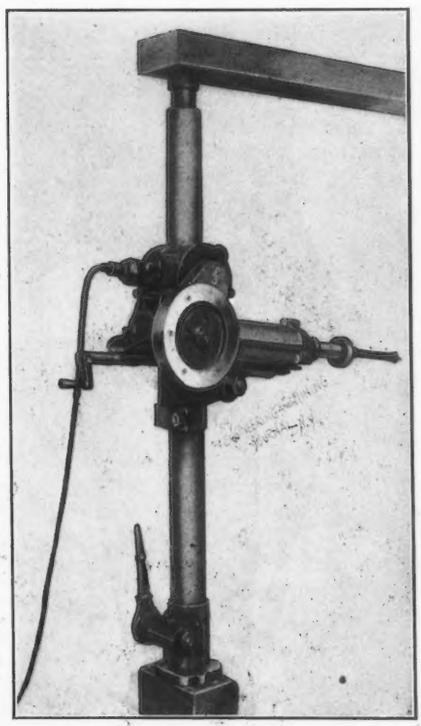
As to cost, it must be noted that this construction permits the use of one wheel with plain hub instead of the more expensive self-oiling hub. The boxes for fastening to the mine-car frame are but little more expensive than the cast-iron holding-blocks furnished for this purpose by the manufacturer aforesaid for the loose-wheel type of truck. The net result is that the first cost per set is not much different in the two cases. The advantages of the tight-and-loose wheel construction are: (1) Far greater durability; (2) Much greater rigidity as a construction approximating to the standard tight-wheel type of construction; (3) In consequence of the two preceding advantages infinitely less trouble with derailments and consequent injury to tracks, cars and wheels; (4) A reduced consumption of oil; (5) As a result of the greater durability with virtually the same cost, lower annual cost for wheels.

There is no intention on my part to patent this construction. In fact, the probabilities are that it is very old in the patent office, but its merits are very high and should be more widely known. I have no hesitation in saying that its universal adoption in the mines of this country would result in a saving of hundreds of thousands of dollars per year.

A Novel Rock Drill

By A. Gradenwitz*

The crank impact-drill represented in the accompanying illustrations has been designed recently by the Siemens-Schuckert works. It is operated by a 1-h.p. motor, fitted directly to the drill and is said to be far more efficient than the usual design of rock drill with flexible shaft and motor box. The electromotor is located in a saddle in the back of the drill and is rapidly removable.



DRILL ON RIGHT OF COLUMN; MOTOR ABOVE DRILL

Like the drill itself, it is inclosed in a dust- and water-proof casing. According as the drill is working on the right or left side of the supporting column, the motor is placed above or below the drill. This difference in the location of the motor, however, exerts no influence on the working of the drill; it may be used as well on a horizontal column or transportable supports provided it is fitted with a special feeding slide. If employed with a convenient fitting, the drill can be used as well for cutting and cleaving.

This electric drill can be used in boring rocks of any hardness. The initial diameters of bore generally vary between 40 and 50 mm., the adoption of a smaller diameter being advisable only in the case of very substantial rock. A length of 5 to 10 cm. per minute can be drilled in hard granite with 35 to 40 mm. diameter of bore, and 15 to 30 cm. in sandstone, according to the hardness of the latter. For drilling soft rock or earth, a rotary drill of lighter and cheaper construction should be used.

A special advantage of the crank drill illustrated is its low consumption of energy, six drills being operated at a time with an expenditure of 10 h.p. The amount of electrical energy consumed by each machine is 1 k.w. and no energy is used up during the exchanging or shifting of the drill, the motor being then stopped.

Current is supplied through flexible well-insulated conductors wound upon transportable drums in lengths of 69 to 100 m. These cable drums are located permanently near the connection box, which contains the terminals of the sta-

DRILL ON TRIPOD FOR QUARRY WORK

tionary circuit and fuses for each pole, the length of the conductor actually used being wound off the drum. At the loose end is attached a substantial plug, designed for rough handling, which fits into a contact box of the motor. After fitting this plug, the operator has only to turn the crank situated on the motor to start the latter as well as the drill.

The motor drives through a spur wheel gearing a double-bearing crank shaft provided with a flywheel, which in turn effects the alternate motion of a slide. In the latter are incased the two working springs surrounding the impact piston, keeping between them the flanged impact box, which is susceptible of a rotation, but not of a longitudinal motion on the piston. The reversal of the drill after

*Berlin W. 50, Regensburgerstrasse 3.

each stroke is effected in the well-known manner by means of a nut with one-sided click which engages with the elongated thread of the impact piston. The click-holder of the ratchet nut is located on springs, so as to prevent any damage to the nut. Two men are required to operate the machine. The weight of the latter, exclusive of the motor, is 100 kg., the removable motor being 47 kg. and the supporting column (of 125 mm. diameter) 115 kg. in weight.

The Chile Mill

By M. R. Lamb*

The article by Captain Narvaéz which appeared in the Journal of Nov. 21, 1908, describing his milling plant, and giving general information concerning his Chile mills, deserves careful study. He makes claims for his mills which are really startling when compared with a combination of stamps and tube mills.

Before analyzing his results it will be of interest to state that approximately similar results are attained by Mr. Pattinson at the El Bote mine in Zacatecas, Mexico, where the same Allis-Chalmers Chile mills are in use. The only difference between the two sets is in the number of mills and in that the Pachuca mills are set in wooden frames, while the El Bote mills have steel framework.

The comparison between the two styles of mill, Chile vs. stamps and tube mills, is shown in the accompanying table. Capacity is based on ordinary quartz such as is produced by the mines of Pachuca. The San Francisco, San Rafael and Progreso stamp mills are treating ore from the same mine that supplies Captain Narvaéz' mill, and this ore is considered to be of average hardness. The ore at El Bote is quite hard and dense, yet the Chile mills crush 18.6 tons per 24 hours through 180 mesh, of which 70 per cent. passes 200 mesh.

The figures given in the table are based on cost of ironwork without framing, as the latter would be about the same in either case. The tubes figured were 3.5x14 ft., and the stamps 1050 lb. Among the points not covered in the table is head room, the loss of which is much less with the Chile mill, thus giving greater latitude in choice of sites. Less actual ground space is also required. Supporting framework, building and erection costs, including a simple hand crane for the Chile mills are about the same in either case, while depreciation, attendance (skilled as well as unskilled), accessory equipment, breakages and probable delays are all decidedly in favor of the Chile mill. The best quality of the stamp mill, its ability to withstand rough handling, is possessed by the Chile mill. Neither over-feeding nor under-feeding has any effect on its continuous operation, these conditions merely reducing capacity temporarily. The accompanying cuts show six such Chile mills as erected in the shops preliminary to shipment to Mexico.

CHILE MILLS ERECTED IN SHOPS READY FOR SHIPMENT

COMPARISON OF CHILE MILLS AND STAMPS AND TUBE MILLS.

	5 Chile Mills.	25 Stamps, 2 Tube Mills.
Capacity to 150 mesh	100 tons	100 tons
Cost of mills and power plant	$24,000	$17,000
Weight of mills and power plant	195 tons	127 tons
Power required	46 h.p.	95 h.p.
Wearing parts renewed	every 2 yrs.	every 3 mos.

According to Consul-General Julius G. Lay, of Cape Town, it is believed that the most promising petroleum field yet discovered in Cape Colony is situated at Zwart Kops, near Port Elizabeth, where one well has already been sunk about 2000 ft. In the district of Carnarvon, there are surface indications of petroleum and a well is being sunk.

Statistics collected for The Mineral Industry show that in 1908 the production of crushed steel in the United States was 630,000 lb. ($44,100), against 840,000 lb. ($58,800) in 1907.

*Milwaukee, Wis.

Selection and Use of Bits for Power Drills

A Discussion of the Different Types of Drill Bits, Bringing out the Effect of Size, Shape and Cutting Edge on the Results Obtained

BY M. DE GENNES

The success of almost every drilling operation depends on the selection and treatment of the bits. If the steel has been carefully selected and the bits properly formed, sharpened and tempered for the work, and if they are changed just as soon as their gages and edges are worn, the results will be economical. The functions of the drill sharpener should be considered as of almost equal importance to those of the chief mechanic in charge of the drills. The best sharpener is not any too good, even if he does not have enough work to keep him busy all the time. It is cheaper to let a high-salaried drill sharpener and his assistant loaf part of the time, than to have two or three drill gangs changing bits every few minutes, or pounding on the drill stem to start the bit when it is stuck, thereby only ruining the inside mechanism of the machine.

Shape of the Drill Bit

The flat bit is the oldest form. When it has a straight cutting edge (Fig. 7), the shock is very severe on the drill; when the edge is pointed (Fig. 6), the shock is less severe, but in both cases, and especially with the straight cutting edge, the bit has great difficulty in turning, and in cutting the outer edge of the hole. Such a bit generally turns in jerks, and makes a three-cornered hole.

With air not highly compressed as was the case in former days, a pointed, flat bit would move so slowly that it would have time to turn in the hole, but even then it was severe on the turning mechanism. As pressures increased, the speed of the bit increased but its turning ability remained the same, resulting in universally three-cornered holes. When a cartridge is put into this kind of a hole, there is always an air space in the corners that detracts from the power of the explosion. Star or mitered bits were then tried, and if they did not come into immediate favor it was because they were so hard to make, even for the most experienced blacksmith. Within recent years specially shaped swages have come into use, and star bits are now easy to make.

The cross bit, which is the form most commonly used, can be made in several shapes. The corners may be behind or in advance of the center; the cutting edges concave or convex, with straight or curved edges; the upset part of the bit may be long or short, thin or stubby; and the angle of the cutting edge may be sharp or obtuse. Let us examine the effect on the rock of each of these forms of bit.

The bit shown in Fig. 8, which is the most commonly used, has a concave cutting edge; after using such a bit, the central part is found to be much less worn than the outer, probably because the blows of the corners weaken the rock at the center of the hole, leaving less work for this part of the bit. With the convex bit shown in Fig. 9, on the contrary, the rock is solid clear to the center of the hole, the corners have less work to do and the center of the bit therefore gets most of the wear.

With the pointed cross bit (Fig. 10) all the work is done by the center, since the corners come into contact only with the fissured part of the rock. The rock around the edge of the hole breaks suddenly, leaving the point of the bit striking alone for a few blows; by the time the full face of the bit has begun to work again, another lateral fissure has formed in the rock, which breaks off suddenly and the operation is repeated. The only advantage of this type of bit is seen in quarries, where holes are put down in line. The shape of this bit permits a hole to be placed exactly where it is wanted, but it works well only in marble, sandstone and other soft, homogeneous rocks.

The X-bit (Fig. 5) is most useful in thinly bedded rock, for drilling holes parallel to the bedding. A cross bit, in these circumstances, is likely to fitcher and give difficulty in turning. The X-bit overcomes this objection.

Shape of the Cutting Edge

Figs. 1 and 2 show two bits designed for homogeneous hard rocks. They are identical except for the angle of the cutting edge; that in Fig. 1 has about the sharpest angle that it is possible to use without danger of breaking the steel. That in Fig. 2 is one that can be used in rocks of varying characters, without change. While working in hard rock, the sharp-angled edges can be used, at full pressure, without danger of blocking the mouth of the hole, since the quantity of rock broken off at each blow is so small that the mud is readily drawn out with the return stroke, especially as this is the more vigorous when working at high pressure. If use is made of this kind of a bit, under full pressure, in a soft rock, the cuttings would be of so much greater volume that they would not be discharged freely, especially as the rebound of the drill in a soft rock is less vigorous. The remedy is either to decrease the speed of the drill, which is not desirable, and only reduces its ability to withdraw the mud, or to use a more obtuse cutting edge (Fig. 4). Sometimes

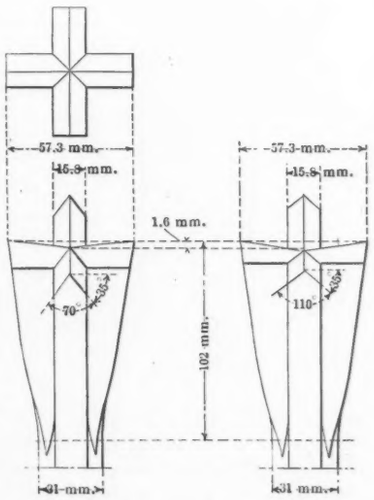


FIG. 1

FIG. 2

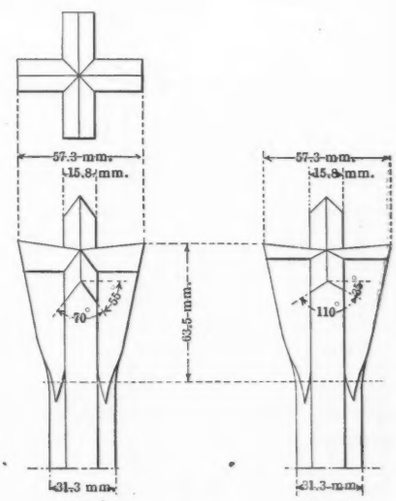


FIG. 3

FIG. 4

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NOTE—Abstract of a paper presented at a meeting of the Société de l'Industrie Minérale, at Paris, Nov. 26, 1908.

the edge must be so obtuse as to be almost flat, to give good results.

Length of Upsetting

The length of the cutting blades, the upset part of the bit, should vary with the nature of the work to be performed. Figs. 1 and 2 show the maximum length for use in a very hard rock; Figs. 3 and 4 show shorter bits, in which the cuttings have a freer opportunity to escape, making this the most desirable form for usual work. A short upset also gives faster clearance of the cuttings. In a rock, however, which grinds the sides of the bit, reducing its dimension rapidly, a long upset should be given.

The wings, or blades, of bits having the dimensions shown in Figs. 1 to 4 should be not less than 16 mm. thick. They must be of the same thickness throughout, to permit rapid removal of the cuttings. If the gage is to be less than 57 mm., the blades may be proportionally shortened.

Gage

In order to maintain a hole to size, it is very important that the cutting edges be straight and not curved, as in Fig. 8. The wear on the corners of such a bit would prevent the maintaining of the proper bore. The amount of work that a bit will do before losing its dimension should be accurately ascertained. In the hardest rocks it is never possible to use a bit the second time, and the greatest length that can be drilled is the total length of the feed, or 60 to 75 cm. in the largest machines. It is necessary, therefore, to have a sufficient supply of bits on hand so that a new set can be used for each hole. In a soft rock, or in an ore, it often happens that the cutting edge is not dulled, even after having made several holes; the runner is then likely to neglect the question of gage, as long as the cutting edge is sharp, and gets into difficulty, for it is the diminution in the size of the hole that causes friction, delays the drilling, wastes power, and adds to repairs.

For example, suppose a workman is given two sets of freshly sharpened steel to bore a certain distance in a moderately soft rock in which, let us say, each set will bore two holes without difficulty. In the third hole, the drills will stick and the workman will pound on the stem with a hammer or wrench, and rather than go to the surface, find the blacksmith and get a fresh set of drills, will waste more time in trying to drive the third hole than he took for the first two. I have known mine managers who have laid heavy penalties on every drill runner whose bits show marks of having been pounded.

As soon as the gage of a bit has been so reduced that its hole fails to take the next following bit, of smaller size, it is better to take a new set altogether. Even if one bit of the set appears to be still good, time will be saved by taking an entirely new set, In a moderately soft rock, in which a bit will satisfactorily drill more than one hole, the engineer should determine by experience just how many holes may be drilled by each set, and the blacksmith and the drill runner need not be consulted in this matter. The runner should be instructed to drill only so many holes with one set as the engineer prescribes, and the blacksmith should be required to furnish bits to exact gage. This plan necessitates a large number of bits, but the advantages in more rapid work and fewer repairs more than outweigh this expense.

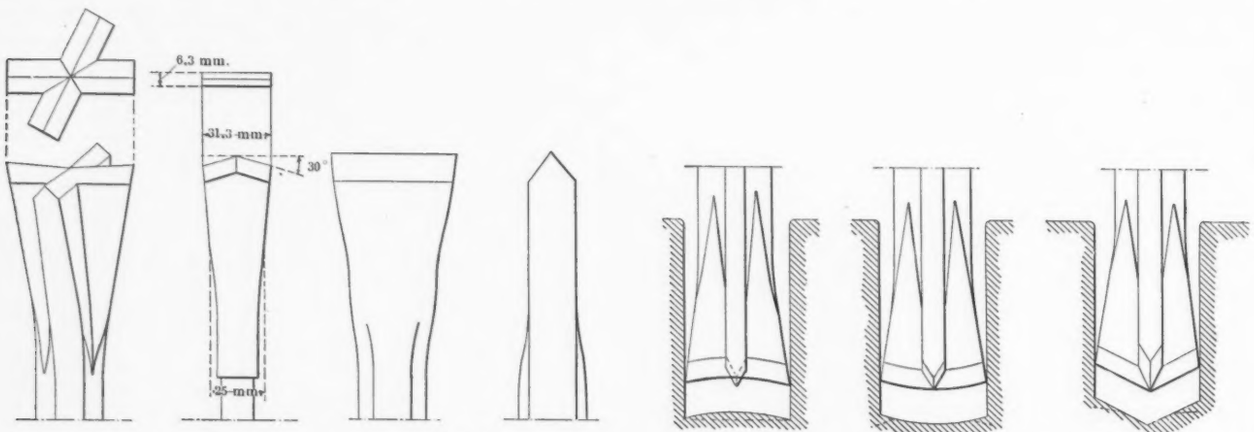

FIG. 5 FIG. 6 FIG. 7 FIG. 8 FIG. 9 FIG. 10

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Statistics collected for The Mineral Industry show that in 1908 the amount of magnesite produced in the United States was 8967 short tons, valued at $52,342. This is larger by 2562 tons than the 1907 production, but the value of the output is lower by $5378. California contributed practically all of the production of the United States.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the four months ended April 30 are valued by the Bureau of Statistics of the Department of Commerce and Labor at $58,155,091 in 1908, and $48,209,062 in 1909; a decrease of $9,946,029, or 17.1 per cent. The leading items of export were, in long tons:

	1908.	1909.	Changes.	
Pig Iron	11,915	10,960	D.	955
Billets, ingots & blooms	54,269	36,264	D.	18,005
Bars	19,125	21,494	I.	2,369
Rails	55,777	69,037	I.	13,260
Sheets and plates	31,464	49,890	I.	18,426
Structural steel	47,332	30,974	D.	16,358
Wire	49,146	55,960	I.	6,814
Nails and spikes	15,762	16,038	I.	276
Pipe and fittings	39,598	49,588	I.	9,990

There were several increases in quantities during the month of April.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States four months ended April 30 were valued at $7,113,203 in 1908, and $7,941,493 in 1909; an increase of $828,290, or 11.6 per cent. Leading items of imports were, in long tons:

	1908.	1909.	Changes.	
Pig iron	32,132	40,232	I.	8,100
Scrap	1,621	1,558	D.	63
Ingots, blooms, etc.	3,059	4,261	I.	1,202
Bars	10,788	5,827	D.	4,961
Wire-rods	4,005	4,157	I.	152
Tinplates	21,699	17,686	D.	4,013
Sheets and plates	895	1,494	I.	599

The only considerable change was the decrease in tinplates.

Iron Ore Movement—Imports and exports of iron ore in the United States, four months ended April 30, long tons:

	1908.	1909.	Changes.	
Imports	238,589	350,440	I.	111,851
Exports	29,646	32,921	I.	3,255

Of the imports this year, 239,082 tons were from Cuba.

Imports of manganese ore four months ended April 30 were 73,626 tons in 1908, and 68,123 in 1909; decrease, 5503 tons.

The Chinese imperial agent at Lhassa has been instructed to prepare a full report on the gold deposits of Tibet.

Operations of Utah Copper Co. During 1908

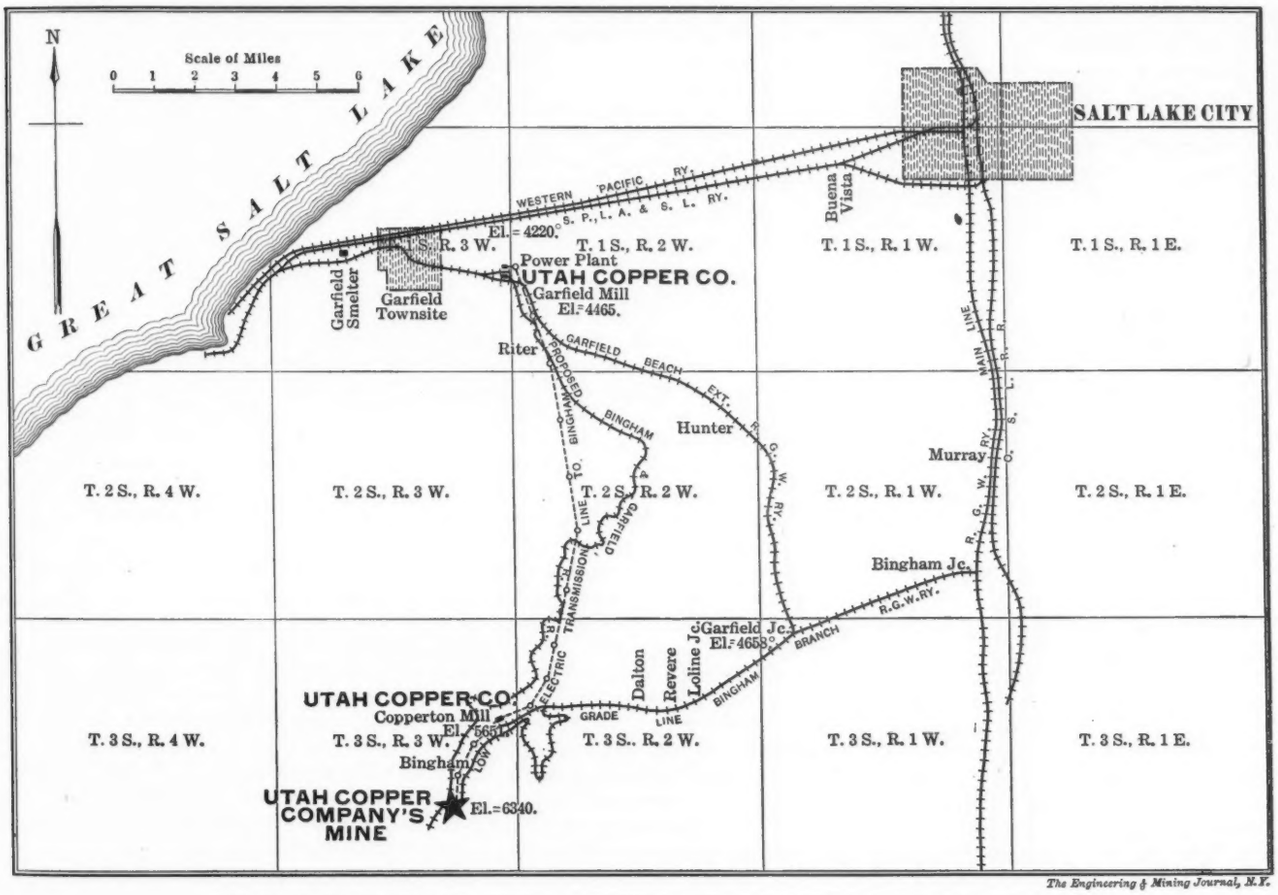
More Than 10 Miles of Tunnels, Drifts and Raises Driven; Proportion of Ore Removed by Stripping Shows Increase; Output 56,895,998 Pounds

BY D. C. JACKLING*

In the last annual report it was stated that the underground developments, on Dec. 31, 1907, amounted to approximately 90,000 linear feet of workings. Since that time, we have driven more than 10 miles of tunnels, drifts and raises; but, at the same time, we have destroyed a very large percentage of our underground workings, partially by stoping operations in connection with our underground mining, but more largely as the result of the operations of steam shovels over areas that had been previously blocked out by tunneling and drifting. The areas containing these workings have, to a certain extent, been dug out by steam shovels but have to a greater extent been excavated by heavy blasting incident to steam-shovel work, so that they are not now accessible. As a result of the destruction of both old and new workings in the manner above described, we have not now to exceed approximately 20 miles of openings available for use in underground methods of mining, or accessible for inspection.

In the report for the year ending June 30, 1907, the statement was made that the developed and partially developed area amounted to 72 acres. Developments since then have resulted in extending this area about 8 acres, so that now the known ore area, fully and partially developed, is approximately 80 acres. The ore thicknesses and values of this additional territory are, generally speaking, similar to those described in the former report, so that the new developments have resulted in additional ore reserves to the extent of about 8,000,000 tons, or at a rate during the period of over three times the rate at which ores were extracted for reduction. The net result of the developments we have made during the period has been that fully developed ore remains approximately as stated in our last annual report, viz., 20,000,000 tons, as the area of this class of ore has been increased to an extent that will more than offset the quantity of ore mined.

The two classes of partially developed ore, described in the former report, have been increased in the aggregate to the extent of approximately 8,000,000 tons, as above stated, so that we now estimate 60,000,000 tons in these two classes of reserves. In other words, of fully developed, partially developed and reasonably assured ore, the total amounts to about 80,000,000 tons. Of this total tonnage, 65,000,000 tons can be classed as of the better or normal grade, averaging about 2 per cent. copper, and 15,000,000 tons as of the lower grade, approximating 1½ per cent. copper. In addition to this, we have the lower zone, as described in the previous annual



The Engineering & Mining Journal, N.Y.

PARTIAL MAP OF SALT LAKE COUNTY, SHOWING RELATIVE POSITIONS OF UTAH COPPER COMPANY'S MINES, MILLS AND RAILWAY CONNECTIONS

*General manager, Utah Copper Company, Salt Lake City, Utah.

NOTE—Taken from the fourth annual report of the Utah Copper Company, for the 18 months ending Dec. 31, 1908.

report, the average value of which has been indicated to only a limited extent by diamond drilling, but which is estimated to contain a minimum of 40,000,000 tons that will probably average 1½ per cent. In discussing the above quantities throughout, consideration should be given to the fact that the stated figures include the quantities of ore mined during the fiscal period. This would amount, in percentage, to approximately 3 per cent. of the above described three classes of ore aggregating 80,000,000 tons reserves.

All the development done during the period has been on the easterly end of the property and on both sides of the cañon, but the larger part of it has been on the south side of the cañon, in the southeasterly portion of the company's territory. The ore-bearing area is still being extended in that direction.

Stripping

Stripping operations since their commencement, in August, 1906, have resulted in the removal of 1,705,322 cu.yd. of capping. Of this amount, 1,335,233 yd. were removed during the fiscal period under discussion. During the first six months of the fiscal period, 367,950 cu.yd. were removed; during the second six months, 446,460 cu.yd. were removed, and during the last six months of 1908, 520,823 cu.yd. were removed.

The total area over which stripping operations have been conducted to date is 19.7 acres. The average thickness of capping, as disclosed by these operations, remains the same as that stated in our last anual report, approximately 70 ft. corresponding to 113,000 cu.yd. per acre. The total amount removed is, therefore, equivalent to stripping of, approximately, 15 acres and, at the present time, the actual area completely stripped is slightly in excess of 7 acres.

The average cost of stripping, throughout the entire operations from their beginning in 1906, has been, approximately, 32c. per cubic yard; this cost covering only the removal of capping and its conveyance to available dumping ground. Applying this cost to the average thickness of stripping removed and ore uncovered, the cost per ton of ore uncovered is somewhat less than 4c. Stripping operations have been more expensive and difficult in the past than they will be in the future, on account of the very limited area upon which the shovels could work and the expensive tracks it was necessary to build in starting these operations in the narrow cañon. As we develop more room, the rate at which shovels can operate will be increased, and the cost of shoveling correspondingly reduced; but the expected decrease in the actual cost of loading the material will probably be offset by the increased cost of hauling the waste material for greater distances, so that it may be expected that our stripping costs will remain about the same as in the past.

Since the last annual report, we have secured by purchase and lease the surface rights of about 120 acres of ground, outside of our own property, for dumping purposes. Of this total area, 75 per cent. was acquired by purchase and the remainder by lease. The total dumping capacity of this surface amounts to 6,330,000 cu.yd., or the equivalent of the capping overlying 56 acres of ore, using the average thickness of 70 ft. so far determined. As a matter of total capacity, the ground already secured will be more than is necessary to accommodate any amount of capping that we will wish to deposit in this vicinity, for the reason that plans are now under way to dispose of the capping in another and profitable manner, as will be hereafter referred to in this report.

Mining

Of the total ore mined during the fiscal period, 33.2 per cent. came from underground, and 66.8 per cent. from steam shovels. During the first six months of the period, the percentages were 39.6 per cent. from underground, and 60.4 per cent. from shovels. During the following six months, the percentages were 34.6 and 65.4, respectively. During the six months ending Dec. 31, 1908, the percentages were 28.7 and 71.3. During the last three months of 1908, the percentages of underground and steam shovel ore were 25 and 75 per cent., respectively. These figures are given to indicate the gradual decrease of underground mining; or, more properly, the steady increase in the quantity of ore mined by steam shovels.

The increase in the volume of ore mined by steam shovels is reflected directly in a corresponding decrease in our mining costs. The average cost of both steam shovels and underground ore for the first six months' period above described was 43c.; for the second period, it was 35c.; for the third period, 30c. The average costs stated cover, respectively, the total costs of every nature at the mine, including development, as well as their proper proportions of all general and fixed charges, such as office expenses, taxes and insurance. The average costs for the entire period, as applying to the two different methods of mining, were 66½c. per ton for all ore mined underground and 19½c. per ton for all ore mined by steam shovel—a saving in favor of the steam shovel method of 47c. per ton.

As has been previously stated, the cost of removing the capping from a ton of ore, as shown by our entire experience in the past, amounts to, approximately, 4c. The net difference in favor of the steam-shovel method, therefore, becomes 43c. per ton; this applying to practically all the steam-shovel mining we have done, as we only mined a few thousand tons by steam shovels before July 1, 1907.

From the beginning of stripping operations to date, the equivalent of 15 acres of ore has been stripped, and the total cost of all this work has been about $550,000. It is proper to add to this, however, a proportion of the cost of grading and laying railway tracks about the property and to our dumping grounds for the disposition of capping. The total net cost of such tracks, and of all other construction incident to stripping operations up to date, including general expenses, has been, after crediting retirement fund, approximately, $285,000. If we charge all the proper proportion of general expenses and 20 per cent. of all the construction costs to the stripping operations, the total cost to date becomes about $690,000. It would not be proper to charge more than 20 per cent. of these construction costs to the stripping already done, because less than that percentage of the area for which these facilities were provided has been stripped. The 43c. per ton saved on ore mined during the fiscal period by steam shovels, as against what it would have cost to mine the same quantity of ore from underground, amounts to, approximately, $695,000. It therefore, appears that had we charged the entire cost of all our stripping operations, from the date of their inception in 1906 up to the present time, against the steam-shovel ore recovered in 18 months only, it would still have been more economical to mine by the steam-shovel method than by the underground method; or, considered in another way, we have stripped 15,000,000 tons of ore, and have mined only slightly more than 10 per cent. of that quantity with steam shovels, but the entire cost of stripping the total quantity of ore could be charged against the mining of one-tenth of it and still the result would show the steam-shovel method of mining our ores to be the more economical.

Our costs of steam-shovel mining will decrease, rather than increase, in the future, and it is consequently quite evident that our best interests lie in decreasing as rapidly as possible the scope of underground mining and correspondingly increasing our steam-shovel output. It will be necessary, for some years to come, to do some underground work, but we will probably be mining fully 90 per cent. of our ore with steam shovels by the end of 1909, and the underground method, as applying to anything but the development and mining of isolated, and comparatively small, bodies of ore, will be gradually, and as rapidly as possible, discontinued.

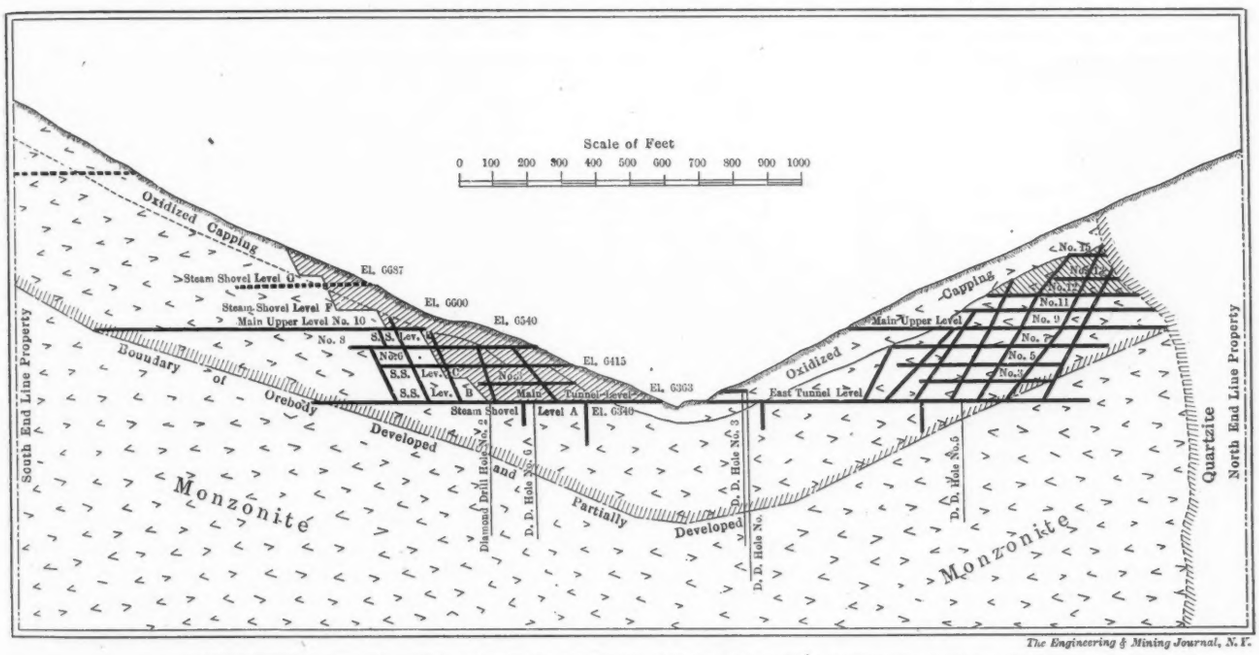
Up to the present time, surface-mining operations have been seriously hampered by our inability to secure from the company transporting our ores to the mills an adequate and regular supply of cars, such as to enable us to continuously and most economically operate our ore shovels. Our surface workings have been developed to such an extent that by the end of 1909 we should have no difficulty in

producing regularly 10,000 tons per day, if an additional unit to the Garfield plant should be decided upon, thus bringing our milling capacity up to the tonnage stated. In the meantime, we could increase our output gradually to the extent of supplying tonnage for the sections of the new unit as rapidly as they could, in all probability, be completed.

The ores that have been mined up to date by steam shoveling have not been as high grade as the normal average of the property, because of the necessity of including with them considerable quantities of the partially oxidized and lower-grade capping. Before steam-shovel operations were begun, some parts of the area where we are now working were mined out for a thickness of 20 to 40 ft., along or below the dividing plane between capping and ore. As this mining was done by caving, the capping settling into the stopes increased the irregularity of the line between ore and capping, and made it impossible to keep the underlying ore as clean as we would have otherwise been able to do. Moreover, aside from this occurrence, which has aggravated the condition, the dividing line between ore and capping is naturally very irregular, and it is impossible to entirely remove all the oxidized material without wasting some good ore. It is, therefore, necessary to continue taking some of this low-grade material into the ore, until such time as the first cut from the top of the ore has been removed over a considerable area; in fact, this condition will always apply to newly stripped areas. This feature is the only one of disadvantage that we have encountered in steam-shovel mining, but, in the long run, there will be advantages which will very much more than offset it —the principal one being that by this method of mining our operations will slowly, but gradually, become more economical, and, in the end, we will have recovered 100 per cent. of our ores; whereas, by any other method of mining, it would be impossible to avoid losing a considerable percentage of them.

Equipment

Since our last annual report, we have added to the mine equipment 2 steam shovels, making 8 in all; 2 locomotives, making 17 in all; and have extended our railroad tracks for mining and stripping purposes to a total of 9.2 miles. During the year 1909 we shall add to our present equipment at least one more shovel and two more locomotives, and shall construct about 6.8 miles of additional standard gage railway for handling capping.



LONGITUDINAL SECTION AND PROJECTION OF UTAH COPPER COMPANY'S BINGHAM MINING PROPERTY

Operations at the Mills

Garfield Plant—In our last annual report, it was stated that four sections of the Garfield plant were in commission. Four additional sections were started—one each in the months of August, September, November and December, 1907; and the remaining four, one each in the months of March, April, July and November, 1908. During the fiscal period there was in operation the equivalent of 8½ sections for the entire period, or about 71 per cent. of the plant. However, the difficulties experienced in obtaining tonnage for the plant, principally through the lack of proper transportation facilities and service, resulted in our being able to provide only 77 per cent. of the rated capacity of that part of the plant prepared for continuous operation, as above stated, or about 55 per cent. of the capacity that the plant is now, and has been since November, 1908, prepared to handle. Had we been able to secure tonnage, the sections of the plant could have been started up more rapidly and the entire plant put in commission at an earlier date.

Copperton Plant—The Copperton plant also suffered from a deficiency of tonnage, but not to the extent that applied to the Garfield plant, partially for the reason that it is closer to the mines. Of the total tonnage treated at both mills during the period, 83 per cent. went to the Garfield mill and 17 per cent. to the Copperton mill.

Production

The total gross output of copper at both plants for the period was 56,895,998 lb. of copper contained in concentrates, resulting in a net production of 54,051,212 lb. after smelter deductions were made. The concentrates produced also contained 182,160 oz. silver and 20,072 oz. gold. The average grade of concentrates for the period was approximately 27 per cent.

Of the total gross production of copper above mentioned, 43,873,918 lb. were produced in the 12 months of 1908, this being 77 per cent. of the total for the period. Dividing the 18 months into periods of 6 months, the respective productions were as follows:

	Pounds.	Per Cent.
July 1 to Dec. 31, 1907	13,022,080	23
Jan. 1 to June 30, 1908	20,096,329	35
July 1 to Dec. 31, 1908	23,777,589	42
Totals	56,895,998	100

Had we been able to secure, throughout the period the full capacity of the 71 per cent. average of the Garfield plant that was in operation, we would have produced at that plant alone approximately 62,000,000 lb.—a total, for both plants, of about

71,000,000 lb. for the period; or an average of nearly 4,000,000 lb. per month. If our entire Garfield plant, which is now in operation, could be supplied with its capacity of 6000 tons per day, and its operation should result in the same percentage of recovery we have experienced in the period under discussion, and upon the same grade of ore, the output for both plants would be at the rate of 96,000,000 lb. for 18 months; or an average of 5⅓ million pounds per month, corresponding to a production of 64,000,000 lb. per annum. This is what we may expect to do in the immediate future, provided transportation for the required tonnage can be supplied; in fact, we can do somewhat better than this on the same grades of ore, if we can have transported all the tonnage needed, as the Copperton plant can also take more tonnage than it has been receiving in the past.

It is to be remembered that the results of the period under discussion have been achieved on an ore containing 4 lb. less of copper per ton than the average normal contents of our ore. In addition to this, because of the low-grade and oxidized material that has been taken into the ore through contamination of the steam-shovel output by capping, the ores have contained an average of fully 5 lb. of their copper contents in oxidized minerals, of which only indifferent percentages could be recovered. Both the grade of ore and the percentage of copper recovered will improve gradually as cleaner ore is procurable, as a result of the extension of completely stripped areas.

Cost of Production

The average price applying to our sales of copper for the entire period was 13.2c. The average cost per pound was 8.85c., this being based upon the net pounds of copper resulting after smelter deductions and allowances were provided for, and including all expenses of transportation, refining and disposition of the metal.

The deficiency of tonnage, as applying particularly to the Garfield plant, has resulted in the cost per pound of copper being fully a cent higher than it would have been had we been able to secure full tonnage for even the 71 per cent. of the plant averaging in operation. As formerly stated, we were able to mill only 77 per cent. of the capacity of the portion of the plant in operation. The additional 23 per cent. which we were unable to mill owing to the transportation difficulties before mentioned, could have been treated at little or no additional cost for labor, and, in fact, not so great a cost per ton, because a shortage of ore involves us in more expensive methods of handling it through our ore bins. We, therefore, would have saved the milling-labor cost on this additional tonnage, which amounts to more than 1c. per lb. of copper produced. If both plants could have been operated at their fullest capacity, a still greater reduction would have been made in the per pound cost. Our other costs would not have increased in direct proportion, as, for instance, the mine, if it had been able to load ore continuously, could have done so at a considerably decreased cost per ton.

Capacity of the Garfield Plant

We have been able to operate the Garfield plant at full capacity only for short periods since it was completed, on account of our inability to transport the tonnage. For a few days at a time, however, we have demonstrated that it can handle continuously a greater tonnage than its rated capacity. This determination has also been checked by the capacity of the individual sections, which have proved themselves capable of treating more than their rated tonnage. No difficulties have been experienced in the operation of the plant, and no changes, other than in the way of unimportant details, have been found necessary. Considering the quality of ore we have been reducing, its operation has been, and is, entirely satisfactory.

Power Plant and Water Supply

The construction and operation of our own power plant, to provide power for the entire enterprise, has proved of great advantage and economy in many ways. We are assured of a constant and uniform supply of power for continuous operation at all points, and the cost of power at the Copperton plant and at the mines at Bingham has been very much reduced over that applying formerly, when power was generated at Copperton for the operation of that plant and purchased from others for the operation of the mine. As stated in our former annual report, the power plant at Garfield has a greater capacity than is necessary for the operation of our milling plants at their present capacity, and it will, therefore, be unnecessary to provide additional power in connection with another 3000-ton unit at the Garfield plant when such addition is made.

Up to the present time, the springs owned by the company adjacent to the Garfield plant, have produced ample water for any tonnage we have handled, and it is believed that they will furnish sufficient for the full capacity of the plant, without making it necessary for us to resort to the use of our proportion of the water we are entitled to take from the Garfield Water Company. We, therefore, have demonstrated conclusively that our total water supply will be ample for very much greater tonnage than we are now prepared to mill.

Transportation

A number of references have been made in this report to the difficulty we have experienced in securing adequate transportation facilities, as provided for under our contract with the Rio Grande Western Railway Company. Our losses, and the disadvantages under which we have operated, as a result of the failure on its part to give us the desired and necessary service, have been greater than would be indicated by the direct deficiency in tonnage that we desired to mine and mill, but which the railway company was not prepared to transport, for the reason that the tonnages that have been delivered to the mills have been handled at a disadvantage and at an extra cost. We have used every effort to induce the railway people to give us better service, but so far without very much encouraging result, and we have, therefore, located and surveyed a line for a railroad of our own between the mines and mills. This location is shown on the appended map of the Bingham and Garfield territory. Negotiations are now pending, which, if consummated, will relieve the situation and give us the transportation facilities we require. If these negotiations fail, I recommend that construction be commenced on our own railway at an early date.

General Remarks

In a former portion of this report, reference was made to a proposed method of disposing of capping. We have found that the 1,705,322 cu.yd. of capping so far removed from our orebodies average not quite 1 per cent. copper. Experiments conducted some years ago, and since verified, demonstrate that the larger part of this copper is contained in such forms as can be extracted by a simple leaching process.

As soon as weather conditions will permit, an open-air plant, of moderate capacity, will be constructed at the Garfield mill, and the proposed metallurgy of this material demonstrated on a fairly liberal working scale. If this experiment proves that our former results along this line of investigation are reliable, it is proposed to build a very large leaching plant in which to treat, along the general lines suggested, the capping removed from the property. The chemicals necessary in the proposed method of treatment should be produced cheaply, as a by-product, at any of the smelters adjacent to Salt Lake City.

The production of crystalline graphite in the United States in 1908 was 3,433,033 lb., valued at $149,763. In 1907 the production amounted to 4,586,149 lb., valued at $149,548. Despite depressed trade conditions the output of artificial graphite continued to increase. The total production was 7,385,511 lb., valued at $502,667, against 6,924,000 lb., worth $58,800, in 1907. This information is gained from reports collected for The Mineral Industry.

The Barrow Hematite Steel Company at Barrow, England, has recently installed a plant of four large blowing engines driven by the waste gases from the blast furnaces. It is the largest plant of the kind in England.

The Largest Coke-oven Gas Engine Plant

A Practical Plan Whereby a Modern Colliery Can Cover All Its Power Requirements at a Minimum Cost and with Maximum Efficiency

BY J. B. VAN BRUSSEL*

The development of the gas-engine power station at the Anna II mine, of the Eschweiler Mining Company at Alsdorf, near Aix-la-Chapelle, Germany, is a good example of how an uptodate colliery is able to cover all its power requirements in a practical and economical way by taking full advantage of recent engineering progress. At this colliery, as at most others, the coke-oven gas was used until recently as fuel for boilers, the steam of the latter being consumed by the different steam engines about the works. Each of these comparatively small steam-engine plants needed special spare engines, and, in consequence, the maintenance and working costs were high. The calorific value of the gas was thus utilized inefficiently, as a steam engine of the best design is only able to transform into power 15 per cent. (maximum) of the calorific value of the gas, without even reckoning the great condensing loss in the long pipes.

Nearly One-third of the Calorific Value Can be Transformed into Power

Good gas engines, however, are able to transform 30 per cent. of the calorific value of the gases into power, and, therefore, the total efficiency of a gas-engine plant is practically more than double that of a steam-engine plant.

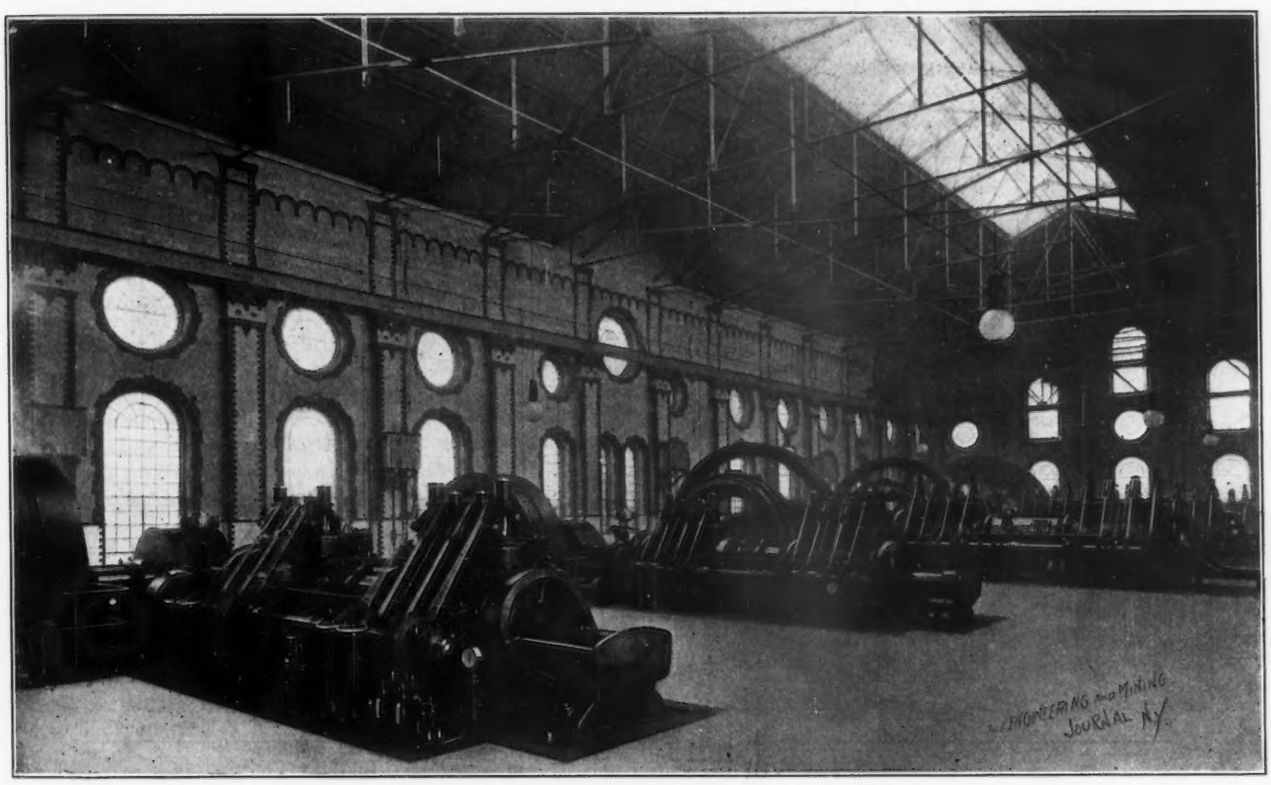
Fully realizing this fact, the directors of the Eschweiler Mining Company decided to scrap the different steam engines, one after the other, and to erect a large power station of gas engines for driving dynamos. The gas engines were to be driven by coke-oven gas sufficiently free from tar, because a by-product recovery plant was to be provided. A special iron-oxide cleaning plant was to be erected for extracting the sulphur from the gas, such sulphur varying in quantity according to the coal used. The installation began with two gas engines of 500 brake-h.p. each, which were ordered from the Maschinenfabrik Augsburg-Nürnberg, for direct coupling to the three-phase dynamos of 500 volts.

Larger Units Were Installed

The coke-oven gas engines of the Eschweiler Mining Company were set to work during 1904. The engines gave such excellent results that it was decided to erect larger units. During 1904 and 1905 three engines—two of 1000 brake-h.p. each and one of 1200 brake-h.p.—were erected, and in 1907 two twin-tandem engines each of 2400 to 2600 brake-h.p. were installed, all being of the Nuremberg type. These were followed in 1908 by a further order for two engines of 2600 to 2800 brake-h.p. each, so that the total output now is 14,500 to 15,000 horsepower.

This total output of 15,000 brake-h.p. represents about twice the amount of power formerly produced by the steam plant, and it exceeds to a large extent the power requirements of the colliery itself. Consequently, one part of the current is used at the Edward pit, where the winding engine is driven by means of an Ilgner transformer, the current having a tension of 5500 volts. Another part of the power, about 3000 brake-h.p., is transformed from 5500 into 35,000 volts, and is transmitted to the Eschweiler mine, about 11 miles distant, where it is used as auxiliary power for the pit pumps as well as for other purposes.

It is further intended to take about 1500 to 2000 brake-h.p. out of this high-tension conduit to the Maria pit, about 1½ miles



GENERAL VIEW OF THE ESCHWEILER PLANT AT ALSDORF, GERMANY

*Brussels, Belgium.

distant. The accompanying photograph shows the gas-engine power station of the Eschweiler Mining Company, which, it is understood, is, or will be—when all the engines now ordered have been delivered—the largest coke-oven gas-engine plant in the world.

The following figures give the results of tests made by Professor Lange, of the Technical University at Aix-la-Chapelle, of the two 2400 brake-h.p. gas engines in Alsdorf. Owing to these tests taking place on a Sunday, it was impossible to overload the engines, but preliminary trials had shown an overload capacity of 16 per cent. At the same time the reliable parallel running of the gas engine, combined in every possible manner and under different loads was well proved:

RESULTS OF GAS-ENGINE TESTS.

	Test 1.	Test 2.
Output in kw	1530	1554
Heat consumption guaranteed in B.t.u. per i.h.p. and hour	8000	8000
Tested consumption in B.t.u. per i.h.p. and hour	6865	6862
Total efficiency, taking the efficiency of the dynamo at 0.945	0.794	0.794
Proved efficiency at full load	0.844	0.857

Following these trials, Professor Lange tested one of the engines—designed for coke-oven gas—with the special object of ascertaining how it would work when driven by producer gas made from coke.

Owing to the quality regulation of the contractors, it was proved that the engine was able to work at full load without any alteration of the valves of governing gear, either with coke-oven gas of 340 to 450 B.t.u. per cu.ft. (3000-4000 cal. per cu.m.), or with producer gas of 113 B.t.u. per cu.ft. (1000 cal. per cu.m.). Such results would not be possible with the so-called "quantity" regulation which is largely adopted.

The producer-gas plant is erected as an auxiliary plant in case of strikes, or if the coal production and the working of the coke ovens is interrupted for any other reason.

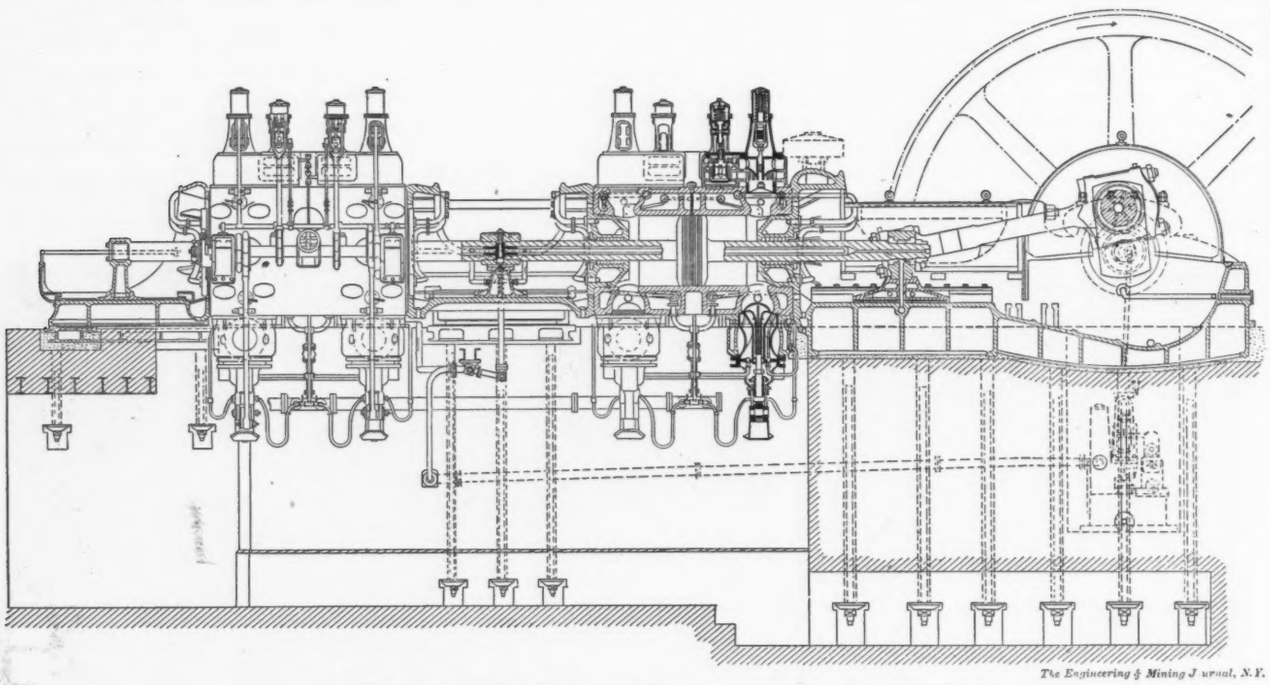
The gas-engine plant of the Eschweiler Mining Company was designed on a large scale, and its actual working proves conclusively the great advantages of large gas engines for an uptodate colliery.

List of Permissible Explosives

As a part of the investigation of mine explosions authorized by Congress in May, 1908, it was decided by the Secretary of the Interior that a careful examination should be made of the various explosives used in mining operations, with a view to determining the extent to which the use of such explosives might be responsible for the occurrence of these disasters.

The preliminary investigation showed the necessity of subjecting to rigid tests all explosives intended for use in mines where either gas or dry inflammable dust is present in quantity, or under conditions which are indicative of danger.

With this in view, a letter was sent by the Director of the United States Geological Survey on Jan. 9, 1909, to the manufacturers of explosives in the United States, setting forth the conditions under which these explosives would be examined and the nature of the tests to which they would be subjected.



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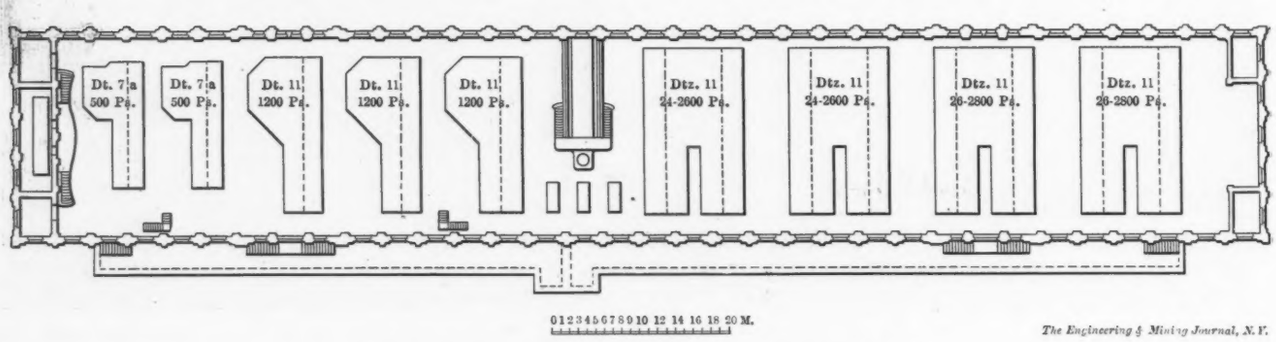
LONGITUDINAL SECTION OF NUREMBERG GAS ENGINE OF 2800 HORSEPOWER



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PLAN SHOWING GENERAL ARRANGEMENT OF GAS-ENGINE PLANT

In response to this communication, applications were received from 12 manufacturers for the testing of 29 explosives. Of these explosives the 17 given in the following list have passed all the test requirements set forth, and will be termed permissible explosives.

Subject to the following conditions, a permissible explosive is defined as an explosive which has passed all the gas and dust-gallery tests. Provided:

1. That the explosive is in all respects similar to the sample submitted by the manufacturer for the test.

(*b*) The permissible explosives are one and one-fourth to one and three-fourths times as strong, and are said, if properly used, to do twice the work of black powder in bringing down coal; hence only half the quantity need be used.

(*c*) With 1 lb. of a permissible explosive, or 2 lb. of black powder, the quantity of noxious gases given off from a shot averages approximately the same, the quantity from the black powder being less than from some of the permissible explosives and slightly greater than from others. The time elapsing after firing, before the miner returns to the working face or fires another shot, should not be less for permissible explosives than for black powder.

PERMISSIBLE EXPLOSIVES TESTED PRIOR TO MAY 15, 1909.

Brand.	Manufacturer.
Ætna coal powder A	Ætna Powder Co., Chicago, Ill.
Ætna coal powder B	Do.
Carbonite No. 1	E. I. Du Pont de Nemours Powder Co., Wilmington, Del.
Carbonite No. 2	Do.
Carbonite No. 3	Do.
Carbonite No. 1 L. F	Do.
Carbonite No. 2 L. F	Do.
Coal special No. 1	Keystone Powder Co., Emporium, Penn.
Coal special No. 2	Do.
Coalite No. 1	Potts Powder Co., New York City.
Coalite No. 2 D	Do.
Collier dynamite No. 2	Sinnamahoning Powder Co., Emporium, Penn.
Collier dynamite No. 4	Do.
Collier dynamite No. 5	Do.
Masurite M. L. F	Masurite Explosives Co., Sharon, Penn.
Meteor dynamite	E. I. Du Pont de Nemours Powder Co., Wilmington, Del.
Monobel	Do.

2. That double-strength detonators are used of not less strength than 1 gram charge consisting by weight of 90 parts of mercury fulminate and 10 parts of potassium chlorate (or its equivalent), except for the explosive "Masurite M. L. F.," for which the detonator shall be of not less strength than 1½ grams charge.

3. That the explosive, if in a frozen condition, shall be thoroughly thawed in a safe and suitable manner before use.

4. That the amount used in practice does not exceed 1½ lb. (680 grams) properly tamped.

The above partial list includes the permissible explosives that have passed these tests prior to May 15, 1909. The announcement of the passing of like tests by other explosives will be made public immediately after the completion of the tests for such explosives.

A description of the method followed in making these and the many additional tests to which each explosive is subjected, together with the full data obtained in each case, will be published by the Survey at an early date.

Notes and Suggestions

It may be wise to point out in this connection certain differences between the permissible explosives as a class and the black powders now so generally used in coal mining, as follows:

(*a*) With equal quantities of each, the flame of the black powder is more than three times as long, and has a duration 3000 to more than 4000 times that of one of the permissible explosives, also the rate of explosion is slower.

The use of permissible explosives should be considered as supplemental to and not as a substitute for other safety precautions in mines where gas or inflammable coal dust is present under conditions indicative of danger. As stated above, they should be used with strong detonators; and the charge used in practice should not exceed 1½ lb., and in many cases need not exceed 1 pound.

Inasmuch as no explosive manufactured for use in mining is flameless, and as no such explosive is entirely safe under all the variable mining conditions, the use of the terms "flameless" and "safety" as applied to explosives is likely to be misunderstood, may endanger human life, and should be discouraged.

Production of Coal in California in 1908*

The total production of coal in California in 1908 was 18,755 short tons, having a spot value of $54,840.

California is not an important coal-producing State, but it is one of the few in which the output in 1908 showed an increase over that of the preceding year. All of the production was the result of recent developments in new territory. The old mines at Tesla, in Alameda county, and at Black Diamond, in Contra Costa county, were idle throughout the year. The recent developments have been at Ione, in Amador county, and at Stone cañon, in Monterey county. The production in those two counties in 1908 exceeded that of 1907 by 4805 tons, and the increase in value amounted to $16,627.

The coal-mining industry of California has been adversely affected, first, by the importation of foreign and better coals, brought largely as ballast, and, second, by the increased production of petroleum and its use as fuel in manufacturing establishments. As a result of these conditions the production of coal in the State had decreased from over 170,000 tons in 1900 to 77,050 in 1905, to 25,290 tons in 1906, and to 13,950 tons in 1907. Up to the close of 1908 all the coal mined in the State had been of the lignite or subbituminous variety. During the last year, however, the development of the mines in Stone cañon, Monterey county, has placed on the market a bituminous coal of a quality adapted to compete with the foreign coals brought into the San Francisco market, and it is believed that this will result, to some extent, in the rehabilitation of the coal-mining industry of the State. It is understood to be the intention of the promoters of this enterprise to cater to the domestic fuel trade, in which petroleum does not figure as a competitor.

The production of petroleum in California increased from 33,098,598 barrels in 1906 to 39,748,375 barrels in 1907, and to 44,861,742 barrels in 1908. This enormous output of crude petroleum has almost eliminated coal as a fuel for railroad and manufacturing purposes in California, where it is used almost entirely for domestic purposes. There is promise of additional coal supplies from Monterey and San Benito counties if transportation facilities are procured.

*As reported by United States Geological Survey.

Mine Explosions and Their Causes*

By James Taylor†

Too much reliance is often placed by the management of our mines on the supposed security of ample ventilation. The most disastrous explosions caused by windy, or blown-out shots in the mines of Illinois, have occurred when the ventilation was of superior character. This is natural, as the oxygen in the good ventilating current aids in the quick ignition and combustion of the carbon-monoxide gas given off by the incomplete combustion of the powder.

The explosive range of marsh gas varies from 6 to 14½ per cent.; the explosive range of carbon monoxide is much wider

*Abstract of paper read before the Illinois Fuel Conference, Urbana, Ill., March 12, 1909.
†State mine inspector.

than this. Carbon-monoxide gas is always found after the firing of shots. This latter gas has much greater power to elongate a flame than has firedamp, on account of its wider explosive range.

The practice in the majority of the mines of Illinois in getting the coal by blasting off the solid, has little to recommend it. Statistics showing the number of accidents and the coal wasted in Illinois during recent years, are so startling that it is evident there should be a betterment in the present system of mine development. As one who is in constant touch with the practical management of mines, I would advocate the abolition of our present system of blasting coal, as the most effective prevention of mine explosions. Although it is useless at this time to advocate a return to the lump-coal system of mining, nevertheless, I believe such a change would be the surest cure for the reckless use of powder and the lack of proper preparation of shots.

Coal Dust a Greater Enemy than Firedamp

It is universally admitted that coal dust is a greater enemy than firedamp; however, it is a fact that sufficient attention is not always paid to the prevention of its production and accumulation. I believe that this end can only be attained by a proper system of mining and a constant and efficient cleaning of roadways, in preference to the adoption of such systems of sprinkling as are now so generally advocated.

We have had several explosions in our Illinois mines caused by a lack of forethought on the part of the mine management. A violation of the mining law, whereby the miners entered the Zeigler Coal Company's mines, on April 3, 1905, after the fan had stopped, caused an explosion in that mine, killing 50 men. A few weeks ago 28 men lost their lives in this same mine, due to a lack of forethought on the part of the management in not making a thorough examination of all the working places before allowing the men to work therein.

It is unfortunate that unskilled labor is gaining a foothold in the coal mines of Illinois. However, the fact that this is so is before us, and a remedy is needed. It is probable that the best way to correct this evil is to make every man that desires a place as a miner, show that he has previously served an apprenticeship loading coal, before he is allowed to handle powder and prepare shots. Life and property are not safe when in the keeping of densely ignorant and inexperienced men.

If our mine inspectors are to render the most efficient service, they should have the power to discharge and to arrest those violating the law. Having such authority, they could compel obedience to all rules and laws, and establish such discipline as to greatly lessen the danger of accidents.

Tests of Life-Saving Appliances for Mines

By Robert Grimshaw*

The experiments here described in detail had for their object to determine how much work a man equipped with life-saving apparatus could do, and to determine the condition of the atmosphere delivered to him. They were made by Wetzke, Christern and Wext of Lubeck; the first a chemist, the latter two, physicians; and were carried out with that thoroughness which characterizes the German scientific investigator—a thoroughness which does not extend to the average German manufacturer or workman.

There was employed to represent the mine or burning dwelling, a workman's house of four rooms in a row; first, a "smoke room;" next a room for the registering instruments; third, a preparation room and the fourth to clean up in.

In the smoke room there were two machines arranged with weights of 20 kg. = 44 lb. each, which should be lifted 1.25 m. = 4.1 ft.; the number of times being registered automatically. Each lift represented 25 meter-kilograms, or 180.825 foot-pounds. Two workmen were employed; Pilz 1.74 m. = 68.56 in. tall, and Holtz 1.66 m. = 65.5 in. Pilz weighed 79 kg. = 174.1 lb. and Holtz, 69 kg. = 152.1 lb. Each was to lift the weight 20 times and then take a rest; so that in each period of work 500 meter-kilograms = 3,616.5 foot-pounds were done.

The tests for carbonic acid were made in about 4 to 5 min. each with a maximum error of ¼ per cent.

Four different apparatus were tried: (A) The "Shamrock," from the Machinen Fabrik Westphalia. (B), (C), (D). Three different apparatus of the Draeger type. In the mouth pipes of the "Shamrock" device, there was 10 cu.in. of air left over; in the "Draeger C," 0.167 liter or 10.2 cu.in. In the new Draeger apparatus D, there was practically none.

The air discharged from the apparatus contained, when no work was done, 2.3 to 2.6 per cent. of carbonic acid; when, however, considerable work was done, the carbonic acid content amounted to from 3.7 to 4.1 per cent. Where the air was held a minute in the lungs, or breathed again and again for the same time, the percentage of carbonic acid was 4.6 to 5.6 per cent.

The Actual Work Accomplished is Lowered by Weight of Machine

Working in the open air, a man, loaded with the apparatus on his back, performed 43,500 meter-kilograms = 314 foot-pounds of work. In two hours, loaded with the apparatus, but not breathing from it, his performance was 40,000 meter-kilograms = 289,320 foot-pounds. This shows that the performance of a man is lowered 8 per cent. by the weight on his back.

Considering the best results obtained with the Draeger apparatus (36,500 meter-kilograms = 264,000 foot-pounds in two hours), it is seen that the work was lowered 8.7 per cent. by breathing in the apparatus. If this loss is considered with relation to a less effective apparatus, where for instance only 18,000 meter-kilograms = 130,195 foot-pounds of work were delivered in two hours, the diminishing of capacity is 55 per cent.

There is a general but false impression that the hurtful effect of breathing carbonic acid may be done away with by breathing oxygen; but oxygen has not this property, and its effect on the human body is only produced when the air breathed is free from carbonic acid. The development of the life-saving apparatus shows a constant endeavor to get rid of the CO_2. The workman were capable of full duty only when the carbonic acid was entirely absorbed.

The ability to work when the lungs are impeded by the presence of carbonic acid is different in different persons; so that some persons can do a good hour's work even with the help of apparatus that delivers air charged with carbonic acid. The two workmen who made these tests were chosen from five; the other three having shown themselves unable to go through with the tests with one of the four apparatuses used.

Five to six per cent. of CO_2 may be regarded as causing "bad air;" 11.5 per cent. is characterized as unhealthy; 18.5 per cent. as dangerous; 27.5 per cent. represents the air as breathed out, and is very poisonous, while with 37.5 per cent. CO_2, the air is deadly.

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According to statistics collected for The Mineral Industry, the production of iron ore in the United States during 1908 fell off badly, amounting to only 33,789,987 long tons, valued at $60,821,976, as against 52,955,070 long tons, valued at $117,560,265, in 1907. The total value for 1908 is figured on an average valuation of $1.80 per ton of ore delivered at lake ports from the Superior field, or f.o.b. in the other localities. Of the 1908 production 33,789,987 tons came from the Lake Superior region, 26,014,987 long tons from the South and 1,875,000 long tons from other States. All three districts produced less in 1908 than in the previous year, but the South fell off less than either the Lake Superior field or New York and the Central States section.

Pig iron is usually sold at gross tons of 2240 lb., though with a few furnaces the old computation of 2268 lb. per gross ton or "sand ton" still prevails. The gross ton also applies to ferro-alloys. Coke is figured at net tons of 2000 lb. always.

Chronology of Mining, May, 1909

May 1—Sale of the Walsh & Seibert coal lands in Indiana for $1,500,000 to the Equitable Trust and Savings Company, Chicago.—Strike at St. Joseph Lead Company's mines, Bonne Terre, Mo. Mills closed.

May 3—Supreme Court of the United States declared the commodity clause of the Hepburn Railroad Rate Act as constitutional.—Fire broke out in the Forest Hill mine of the Pittsburg Coal Company, Smithdale, Penn.—Fire in North Mahanoy Colliery, Penn., under control.

May 4—Lake navigation opened at Houghton, Mich.

May 5—Pittsburg Coal Company, Westland, Penn., resumed operations after being closed 8 months.—Meeting of representatives of 79 independent coke plants at Uniontown, Penn., to plan consolidation.

May 6—Construction of 560 by-product coke ovens at Gary, Ind., begun by the United States Steel Corporation.

May 7—The Stockton Colliery, Penn., employing 800 men, suspended operations until the fall.—United States Steel Corporation announces the opening of the ore shipping season on the Lakes.

May 9—Fire in the United States Geological Survey's building at Washington, D. C.—Fire broke out in the Dos Estrellos Mines, El Oro, Mexico.

May 11—The directors of the Shannon Copper Company voted to finance the Shannon & Arizona Railroad.

May 12—The merging of the Consolidation, Fairmont, Somerset, Clarksburg, and the Pittsburg & Fairmont Coal companies, and their subsidiaries, controlling 200,000 acres of coal land.—The Ohio Coal Company, Evansville, Ind., resumed operations.—The Cullman Coal and Coke Company incorporated with headquarters at Cullman, Alabama.

May 14—Labor strike at New Idria quicksilver mines, San Benito, California.

May 17—Opening of navigation on Montreal river.

May 18—Murray plant of American Smelting and Refining Company resumed operations after a brief shut-down due to labor troubles.

May 19—Ohio Mining Commission met at Canton to formulate new laws suitable to operators and miners.—Death of Henry H. Rogers, president, Amalgamated Copper Company.—Frick Coke Company started 1000 additional ovens.

May 21—The $60,000,000 merger of coke plants was completed.

May 22—Largest week's zinc-lead shipment from Joplin district for more than one year.—Price of zinc ore reached $43.50.

May 23—A silver nugget weighing 3000 lb. was found at Cobalt, Ontario.

May 25—Six thousand miners go on strike in the Kanawha field.

May 28—A formal agreement made whereby the Standard Oil Company will control the Galician oil fields.—Hayden, Stone & Co., purchased control of Santa Rita Copper Company.

Mines as Investments

By George D. Stonestreet*

To many laymen the idea of investing in mines seems to suggest gambling, and not legitimate business. Many conservative bankers and staid old business men politely and firmly show the mining promoter the door, and would never allow their names to be attached to any investment where mining is undertaken as a source of revenue. From their point of view such men are correct enough in pronouncing mining a gamble, and in the days before the advent of trained mining engineers they were justified in refusing to look upon mining as an investment. It was usual, 20 years ago, and even now to a smaller extent, to promote a mining property by specious advertisement, untrustworthy reports by alleged experts, and by the sale of stock many times below par value. While it is true that some mines so promoted have succeeded, they have done so in spite of their promotion and management, but 99 per cent. of such promotions usually fail and properly so.

The education of the public on mining matters is important from two viewpoints: (1) That gambling in mines may be stopped, and vast sums of money saved from going into the pockets of unscrupulous promoters; (2) that the public be instructed in careful uptodate methods of investigating prior to making investment. That such investment can really be called such is a well proved fact today. A mining engineer of standing in the financial world signing a report upon a mine in favorable terms, has the effect of engaging the attention of capital as an investment to the extent of any number of millions which may be required.

Should plain John Smith sign a good report upon a mine, his name, carrying no weight, would have no effect on this class of investors, and ranging between the engineer of international mining fame for skill and probity down to John Smith of unknown skill and doubtful honesty are many thousands of engineers more or less capable. All of the best of these will testify that mining can be made a legitimate investment and can prove their assertion.

Iron and coal mining are today well removed from the promoter's wily ways, and his attention is now usually directed to gold, silver, or copper mining. The following advice may be tendered to the public on mining promotion. When the promoter calls, ask him the following questions and note that in most cases he will be totally unable to answer them:

(1) Is this a mine or only a prospect?

(2) Should the promoter claim it to be a mine, then ask him how many tons of ore are in sight, who measured them, how the measurement was made, what is the value per ton of ore in sight, how is that value arrived at, and if he has plans of the mine showing its development and value.

(3) Who was the engineer who reported upon the mine, what are his qualifications, and who are his references?

(4) Who are the directors? Have any of them had experience in mining-company directing?

(5) What amount has been spent upon the mine to date, who vouches for this, and what did the property originally cost?

(6) What is the capital stock? How and to whom allotted, and why were they so allotted?

(7) What is going to be done with the money you are now seeking to get out of me, who is going to spend it, who says it will accomplish what you intend it for?

(8) Who is the manager of your mine and what experience has he had to justify his position?

(9) What are the metal contents of ore in the mine, their value, and what process of recovery do you intend to install to recover those metals? Who advises you on this process, and what has been his experience with this class of ores?

(10) What figures have been made to show the probable life of the mine and who made them; in other words, for how many years may I expect dividends, and at what rate?

(11) What title have you? In whose name does the property stand? Is it fully paid for?

He may say, "Your questions are good, but I am only dealing with a prospective mine," and if he says this, it is no investment, but has only a bare chance of becoming a mine. Exploration and development companies should do this prospecting work, for which they are properly equipped, and for which the ordinary promoter certainly is not. Should the promoter claim that he is selling shares only in a prospect then ply him with questions 3, 4, 5, 6, 7, 8, 9 and 11, and upon the answers being returned, use your best judgment, together with that of some reputable engineer. For just as you would consult your doctor, or your lawyer, so should you consult your engineer. Pay him for his advice and then take it.

In conclusion, a word should be said about a large class of men who put money into mining only for the chance it affords to unload on someone else at a higher figure. They do so without inquiry into the merits or demerits of the property, but these men will be eliminated by a natural process if the careful businessman will act on the advice tendered herewith.

*Mining engineer, 45 Broadway, New York.

Progress in Cyanidation*

By Alfred James†

It is rather interesting, if at first sight somewhat disappointing, to note that recent developments in cyanide work have been almost entirely mechanical. And yet that such should be the case is surely a tribute to the band of chemists, prominent among whom were MacArthur and Ellis, who over 20 years ago investigated so thoroughly the chemical side of the process that even today one is forced to acknowledge that chemically the cyanide process stands almost where it did at its introduction.

The use of oxidizers such as atmospheric air, ozone, sodium dioxide, and ferrocyanide of potassium, put forward or investigated by Montgomerie, Moldenhauer, Julian, Kendall and others; the application of alkalies; the use of lead salts now carried to such an extent in the treatment of the silver sulphide ores of Mexico; and even the addition of a granular coating of lead to the zinc shavings, were all recommended or patented in the early days of the process; the use or addition of the halogen salts of cyanogen, including the bromide, iodide and chloride, were all investigated and advocated by Doctor Gaze in New Zealand in the early '90s, and more fully later by Sulman and Teed.

From the earliest days the addition of hypochlorites was investigated in certain quarters (bleaching powder was in actual use on the Kalgoorlie field in 1901); but all these accelerators or "improvers," as well as mercuric cyanide (Doctor Keith), and alkaline persulphates including ammonium persulphate patented by Dr. G. A. Schmidt in 1895, have been generally discontinued in practice owing to the increased cost of the improved process without corresponding benefit. The bromocyanide process alone may claim to have shown definite and continuous commercial results in practice and it probably would have persisted but for the incidence of cheap roasting which has permitted of higher recoveries at lower cost.

Mechanical Developments

It is on the mechanical side, therefore, that we find most recent developments. And here we are confronted by a change in practice that amounts to a revolution. No longer does one aim generally at crushing an ore as coarsely as possible and with a minimum production of slimed products. On the contrary, the higher recovery obtained from the slimed products has resulted in the adoption of an entirely new method of crushing the ore, of dissolving out the gold and silver and of recovering the valuable solution from the pulp.

And so passing over the development of the roasting furnaces which now roast refractory telluride and sulphide ores down to as low as 0.01 per cent. of sulphur as sulphide at 2s. 6d. per ton roasted, one comes to the finer crushing of the ore and to that great development of the last few years, the tube mill, the use of which has been publicly stated to be the greatest development in gold-ore treatment since the introduction of the cyanide process. The higher extractions obtainable from the more finely crushed ore are claimed to result in an extra profit of 2s. per ton in South Africa, or say an additional £2,000,000 per annum for that field.

Agitation

But the finer crushing of ore has led to another development, and that is the circulation of cyanide solutions through the mill, instead of through the leaching plant only, as formerly. This practice is now widely followed in Australia, America and eastern Asia. From time to time, statements accompanied by charts appear in the technical press showing the extra extractions resulting from this practice. As the getting of the gold into solution by percolation in tanks, as of old, is out of the question for a large proportion of the finely slimed product, it has been necessary to effect solution by keeping the pulp in suspension in the cyanide liquor.

This is accomplished naturally during the crushing and transfer of the pulp where cyanide solution is circulated through the mill but the period of contact thus afforded is usually insufficient. Mechanical (paddle) agitators have, therefore, been employed as has also air under pressure—notably by Mr. Moss at the Kalgurli Gold mine—but in practice the latter has proved much too expensive a method and the former has not been entirely satisfactory whether from a mechanical or commercial point of view.

Recently an ingenious modification of the principle of the Pöhle air lift has been introduced in New Zealand where they use tall tanks in which the lessening of the specific gravity of the contents of an inner tube resulting from the introduction of bubbles of air tends to rapid and most energetic displacement of the pulp contained therein with consequent effective agitation of the mass of pulp contained in the outer tank and surrounding the inner tube. This apparatus has been found very efficient and to require much less power than the mechanical agitator and it has been adopted already in the various great goldfields of the world.

Treatment of Silver Ores

These notes would be incomplete were I not to refer to the recent great development of the cyanide process in its application to the treatment of silver ores. The mechanical developments mentioned above are possibly mainly responsible for this. In the ordinary way, so long a period of agitation is required for the recovery of the silver content of a sulphide ore that the necessary mechanical agitation of the finely slimed ore for some days was found to be a very expensive matter. This time, however, has been very materially reduced by the use of the air-lift system of agitation above referred to and already a large proportion of the silver output of the world is now produced—particularly in Mexico—by the use of tube mills, air-lift agitators and vacuum filtration.

But with the growing tendency to finer crushing and the greater production of slimed pulp, the necessity became more pressing for the provision of a cheap and effective method of recovering the valuable solution from the slimed pulp. In the early days of the process, when confronted with a New Zealand ore which one could not leach in vats, we used filter presses for this purpose and later Ellis treated similar Chilean ore by decantation as the most convenient method available, and until the general adoption of tube mills the mining world was content to treat its slimed pulp by one of these two methods. In West Australia filter-pressing received its greatest development, recoveries of 97 to 98 per cent. of the dissolved gold being obtained at a pressing cost of 1s. 6d. per ton pressed. In South Africa, J. R. Williams worked out a practical method of applying decantation which resulted in some of the highest installations ever erected and possibly the highest recoveries ever obtained in practice by a displacement process.

Vacuum Filtration

But with the increased proportion of slimed pulp resulting from the use of tube mills, greater attention has been paid to providing an effective method of recovering a high percentage of the dissolved contents and one is now confronted with perhaps the greatest development in the cyanide process of recent years, the adoption of vacuum filtration. Acting on the basis of the adherence of a mass of filtered cake to a vertical or downward-facing filter until displaced by the discharge of the vacuum or by the application of back pressure, large equipments have been erected (some of them treating upward of 1000 tons of slime per day) for obtaining at a low cost the dissolved contents of the slimed pulp. Of the success of this latest development of the cyanide process one may judge from the increasing size of the equipments being erected, and from the published statements of a cost of from 3d. to 4d. per ton handled and of a recovery of 99.5 per cent. of the dissolved contents (average for the month of November at a plant treating over 500 tons per day) and from the fact of the

*A paper presented under the title, "Recent Developments of the Cyanide Process," at the International Congress of Applied Chemistry, London, May 28, 1909.

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treatment—if one may rely on published records and statements—of no less than 5,000,000 tons of slimed pulp by this process during the last 12 months.

Magnetic Oxide in Matte

By E. L. Larison*

For many years an intermittent controversy has gone on regarding a more or less important constituent of copper mattes, magnetic oxide of iron. Some observers go so far as to deny, or at least doubt, its existence.

Although the grounds for such an opinion are surely lacking in many cases, there is no doubt about the fact that a great many mattes when treated with nitric acid do not completely dissolve, but leave a residue of magnetic oxide. This residue often amounts to several per cent. of the quantity taken, and in such cases appreciable amounts can be obtained to work with, and no mistake as to the nature of the substance is credible. The fact of the existence of the residue and its certain identification being established, only one explanation can be put forth in support of the idea that magnetic oxide does not exist as such in the mattes. That is, that it is produced by the action of HNO_3 on the iron sulphide or metallic iron in the matte.

This theory was presented very clearly and with some supporting experimental data by Gibb and Philp.[1] The substance of their argument lay in two points: (1) They show that with increased quantities of oxidizing reagents [HNO_3 and $KClO_3$] increased quantities of the residue of Fe_3O_4 result on a given matte, showing that at least the amount and strength of the oxidizers have a quantitative influence. (2) The residue of Fe_3O_4 formed in their experiments was soluble in H_2SO_4, whereas Fe_3O_4 formed at the high temperature of a blast-furnace tuyere region should be very difficultly soluble in H_2SO_4.

Two Possible Sources

This theory is somewhat out of the ordinary, as Mr. Keller remarks in his criticism of the original paper. Without going into the theory of the oxidation reactions which might take place, two experimental facts will, nevertheless, have weight. Ordinary FeS which was made by melting together Fe and S and which contains excess Fe and is magnetic, leaves no residue of Fe_3O_4 on being treated with HNO_3 or $KClO_3$; also the Ducktown smelter mattes which are nearly pure Cu.Fe.S combinations, similar to those described by Gibb and Philp, give constant residues irrespective of the amounts of the oxidizing solvents used. This residual Fe_3O_4 is soluble with difficulty in H_2SO_4, which, however, does not prove that the Fe_3O_4 was formed in the furnace.

If we grant that Fe_3O_4 does exist as such, in the matte as it comes from the furnace, there are two ways of accounting for its presence. The first is that it is formed in the furnace by action of the blast on the iron sulphides; the second, that it was present in the charge as mineral magnetite and went through the furnace unchanged, in part, at least. The theory of formation in the furnace was brought out very strongly in Doctor Peters' "Modern Copper Smelting," being attributed to high-pressure blast acting on fused FeS. Doctor Peters at that time went so far as to suggest using low-pressure blast produced by fans, and enlarging the tuyeres to admit the necessary amount of oxygen. This theory was pretty well demolished when Mr. Keller pointed out that often reverberatory mattes, produced in furnaces using natural draught, contain large percentages of Fe_3O_4. Also that the blister copper and the slag from converters, in which exceedingly high blast pressures are found, often contain very little or no Fe_3O_4. Doctor Peters, in his later "Principles of Copper Smelting," does not speak so strongly as to the formation in the furnace, though he still says that it "may be formed under conditions as yet disputed in both reverberatory and blast furnaces."

Unaltered Magnetite

The alternative, i.e., that the magnetic oxide found in mattes is simply unaltered magnetite which existed in the ores seems a reasonable and natural explanation. It has long been observed that the mattes made by pyritic smelting of the Ducktown heavy sulphide ores always contain magnetic oxide. Recently in making "mineral analyses" of the ores it was found that these ores contain very appreciable percentages of magnetite, and it was this that brought the subject to mind. The evidence which could be obtained with very limited time follows:

There are two ores from mines three miles apart. Both are heavy sulphides, but they differ in some respects mineralogically. I will call them Nos. 1 and 2. No. 1, which produces the ore regularly smelted, contains from 2 to 3 per cent. of magnetite; No. 2 ore contains 12 to 14 per cent. magnetite. The first matte (about 20 per cent. Cu.), made from ore No. 1, contains approximately 3 per cent. Fe_3O_4., varying from 2 to 3.5 per cent., and apparently the higher percentages with the richer mattes. When this matte is concentrated by putting it through the furnace again, with only quartz and a small amount of coke, a matte ranging from 45 to 55 per cent. copper is produced. This matte carries on an average about 5 per cent. of magnetic oxide.

The ore which I have called No. 2 is not regularly smelted at present as it is rather low in copper. But some time ago a test run was made with it for about two weeks, and many matte samples were obtained, running from 5 to 30 per cent. copper. Many samples of different copper tenor were run for Fe_3O_4, and the amounts varied from 10 to 30 per cent. Only one sample tested, a 4.9-per cent. copper matte, contained less than 10 per cent. Fe_3O_4.

With these mattes the lower percentages of Fe_3O_4 in general were with the lower-grade mattes until the copper percentage reached about 25, when the Fe_3O_4 appeared to decrease. The mattes were all tested with a magnet. Those made from the No. 2 ore, which contained the high Fe_3O_4 percentages, were distinctly more magnetic than those from No. 1 ore. The corresponding slags were also tested, and again the slags of No. 2 ore were much more magnetic than those of No. 1 ore. I realize that this data is not as full and detailed as it should be to be used in comparison with that of other obserers, but It pretends only to be incidental, and it is hoped that it can be made more complete when time allows. However, what little is here presented, I think justifies some generalization.

Conclusions

It seems clear that the charges which contain the greater amounts of magnetite produce mattes higher in Fe_3O_4 than those from the charges low in magnetite. The mattes, of course, do not account for anywhere near all the magnetite charged, but the fact that the slags in every case are distinctly magnetic, and that this property varies with the magnetite charged, partially at least, accounts for the difference. Also, it is probable that part of the original magnetite is lost by reduction, and combination with SiO_2. Knowing that there is magnetite in the charges, it is fairer to assume that it partly, at least, goes through the furnace unchanged, than to assume that it is mostly reduced and slagged, and new Fe_3O_4 formed by blast action.

It has been suggested that the difficult solubility of Fe_3O_4 from mattes in H_2SO_4 indicates that the Fe_3O_4 was formed in the furnace at a high temperature. This is offset in the present instance by the fact that the magnetite in these ores is also very hard to dissolve in H_2SO_4, or even HCl, and the passage through the furnace would not tend to make the solution easier. In the articles that have been published on this subject I have never seen any figures on the magnetite content of the ores from which the mattes quoted were produced. Figures on this point from various ores from different districts would, I think, be of much value in solving the question.

*Chemist, Ducktown Sulphur, Copper and Iron Company, Isabella, Tenn.

[1] *Trans.*, A. I. M. E., Vol. XXXVI, p. 665.

Colliery Notes

With proper equipment, a small peat-bog of from 50 to 70 acres will supply a moderate power plant for a good many years. Wet peat with 45 to 50 per cent. of water can be burned successfully in a gas producer; however, the air-dried material of about 25 per cent. water is much more desirable, if the producer process is to go on smoothly and turn out a rich gas.

Artificial wood manufactured from peat is being successfully introduced in Germany. In 1908, peat-wood blocks were used for paving a street at Dresden. Although this street has handled heavy traffic, the trial has showed good results, in spite of the frequent changes of temperature which occurred last winter in Germany. The advocates of this kind of paving claim that the peat-wood blocks are better than asphalt, and that they lessen the noise of carriage traffic equally as well as an asphalt pavement.

According to Arthur E. Taylor, a peat expert of Findlay, O., the peat deposits in Indiana cover about 200,000 acres, or 312 sq.m., and occur in the three northern tiers of counties. The peat beds appear in the sites of old glacial lake basins. Practically all of the workable deposits of Indiana are limited to the counties found in the Lake region, and most of the beds have had their development in these lakes. The filling of these lakes by vegetation undoubtedly began as soon as the ice receded, and is today going on in some degree.

The general idea that marsh gas, so common in coal seams, accumulates and remains in cavities in the roof and higher places of a coal bed, is considerably in error. It is true that this gas is lighter than air, and that as a consequence its presence may sometimes be first noticed in such cavities and high places; however, the accumulation of marsh gas in such places will be only temporary. From the moment the gas is liberated, it is largely governed by the natural law known as "the diffusion of gases," and it immediately begins to mix with the mine atmosphere. In order to prove the foregoing statement, it is only necessary to take two bottles, one filled with ordinary air and the other with methane; connect these bottles with each other by means of a tube passed through a cork inserted in the neck of each bottle; it will be found that after a short interval of time the two gases will have mixed uniformly, and this will occur even though the bottle containing methane is placed uppermost with its neck directed downward toward the other bottle.

The question of watering mine roadways has given rise to much discussion. To ascertain the exact effect that sprinkling has on the roof and sides, interesting experiments were recently carried out at an English colliery. In three distinct seams, a pair of places were driven parallel, about 60 ft. apart; one of the places was watered each working day, that is, five days a week, for three months or more, while the other was left alone. The water was applied with an ordinary greenhouse syringe, about two buckets of water being used on 60 ft. of road; the width of the road was about 12 ft. In the first seam, the measurements showed that in the case of the watered place, the roof lowered, or the floor lifted as much as 14, 7, and 16 in. at three specially selected points; the unwatered place did not alter more than ½ in. In the second seam, the roof of the watered place broke up and fell, at some points, to a thickness of 2 ft.; the unwatered place lowered onto the packs, but did not break up. In the third seam, the roof of the wet place broke up to a hight of 20 in., while the dry place remained unaltered.

A careful investigation of the many recent experiments where calcium-chloride has been applied as a remedy for dust in dry mines, shows that this treatment is simple, rapid, inexpensive and efficient; it also facilitates the proper care of distant or inaccessible parts of a mine. In some instances, a solution of calcium-chloride was used, in other cases, a calcium-chloride powder was the agent. It was found that when the solution was applied to the sides or roof, the effect was just as damaging as though water was used. At one mine, 90 gal. of calcium chloride were used to treat 225 ft. of main road; the application kept this part of the road clear of dust for three months. There was no alteration in the hight of the road. At another property, 330 lb. of calcium chloride, previously ground to a fine powder, was sprinkled on the entry floor for a distance of 249 ft., no dust having been previously removed. On the following day, the road was wet and no dust arose. When the road was examined two months later, the effect was still visible. Judging from this experiment, one application every three months would be ample. The powdered calcium chloride was sown on dry by hand, 330 lb. being put on 2241 square feet.

A recent invention enables the manufacture of artificial wood from peat. The wet peat is washed without changing the natural fiber, after which the material is mixed with hydrate of lime (water-slaked lime) and with an albuminous combination, and, perhaps, argillaceous earth, the entire mixture being pressed in molds with a pressure of 6400 to 7100 lb. to the sq.ft., the excess of water being released by the pressure. After a short application of the pressure, the board can be taken out of the mold, when it is already very strong and needs only to be completely dried in the open air and worked to the necessary dimensions to be ready for use. The boards produced by this method can be worked as easily as natural wood, although their strength is much superior to the strength of the natural wood. They can be polished and painted, and according to the statement of the inventor, are 30 to 50 per cent. cheaper than articles made out of good oak wood. The artificial peat wood is suitable for: (1) flooring of every kind; (2) doors, fireproof stairs, ceilings, panels, and all other cabinet work; (3) sidewalks and roof coverings; (4) railroad ties; (5) pavements for streets and factories; (6) complete furniture from the simplest to the most elegant design. The artificial wood is not hygroscopic, and does not require painting or impregnation for use in the open air. The new peat wood is also fungus-proof and very little affected by heat.

Before useful suggestions can be made as to the treatment of coal dust, so as to render it innocuous, it is necessary to obtain some idea as to the rate at which dust is deposited on underground roadways. In this connection, Henry Hall, the English mine expert, recently made valuable experiments in an endeavor to solve this question. With this object in view, aspirators were fixed in a return-air road at intervals of about 75 ft. The action of the aspirator is by means of cotton-wool; the air is drawn through it, and the dust deposited in transit, the cotton-wool being carefully weighed before and after the operation. After collecting data from a number of such experiments, Mr. Hall found that something like 11½ lb. of coal dust were carried in 8 hours past the point where the measurements were taken. The velocity of the current of air carrying this dust was 95 cu.ft. per minute. The result also proved that there was a gradual diminution of the dust as it traveled out-bye; there was no traffic on the road on the out-bye side of the point where the aspirator was placed, while the experiments were being carried out. Still other measurements were made, with the object of arriving at the quantity of dust deposited on the floor, sides, etc., as it was being carried along by the ventilating current. In these latter experiments, flat porcelain dishes having an area of 1.12 sq.ft. were used. The time allowed for making the measurements varied from 8 to 10 hours on two separate days. The results of these experiments showed that at the shaft-bottom, where the area of the road is 150 sq.ft., 18 lb. of dust are deposited each working day of 12 hours. If it be assumed that this road averages 12 ft. in width and that ½ lb. of dust per lineal foot of such a road is required to make an explosive mixture of dust and air, starting with a clean sheet, it would require 83 ordinary working days to render this 3000 ft. of road at the bottom of the shaft absolutely dangerous. The deposits of dust, of course, will be thicker near the shaft than farther in.

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Consumption of Spelter in the United States

We have previously, in the JOURNAL for Feb. 27, 1909, reported the production of spelter and zinc ore in the United States in 1908, and the deliveries of spelter for consumption, the figures then given including the production of virgin spelter only. We now reproduce those figures, together with our report for the production of reclaimed spelter, i.e., the metal derived from the resmelting of dross and other waste products.

DELIVERIES FOR CONSUMPTION.

(IN TONS OF 2000 LB.)

	1907.	1908.
Stock Jan. 1	4,550	32,883
Production(*a*)	249,612	210,511
Production(*b*)	18,000	12,150
Imports	1,778	881
Total supply	273,940	256,425
Exports	563	2,640
Stock, Dec. 31	32,883	25,000
Deliveries	239,494	228,785

(*a*) Virgin spelter. (*b*) Reclaimed spelter.

According to the above figures it appears that the deliveries of spelter for consumption were 239,494 tons in 1907 and 228,785 tons in 1908. We have previously called attention to the probability that the reports from the consumers would fail to show so large a consumption in 1908 as the computed deliveries would indicate. It is impossible, for obvious reasons, to obtain reports from the consumers accounting for the entire consumption, there being so many small concerns which keep no records, or which it is impossible to reach. However, the reports that we have received account for so large a proportion of the total that they afford an excellent indication of the status of the consuming industries, especially inasmuch as they can be compared with the reports of the same concerns for the previous year. Upon this basis we estimate the consumption in 1907 and 1908 as follows:

CONSUMPTION OF SPELTER.

(IN TONS OF 2000 LB.)

Purpose.	1907.	1908.
Galvanizing	150,000	119,000
Brass-making	44,000	33,000
Sheet zinc	30,000	27,000
Lead desilverization	2,600	2,500
Other purposes	12,894	10,000
Totals	239,494	191,500
	Per Cent.	Per Cent.
Galvanizing	62.7	62.2
Brass-making	18.4	17.2
Sheet zinc	12.4	14.1
Lead desilverization	1.1	1.3
Other purposes	5.4	5.2
Totals	100.0	100.0

It will be observed that we have revised the figures previously reported for 1907 in order to take in the consumption of reclaimed spelter. The change that we have made in the figures has been chiefly in the case of the consumption of spelter for "other purposes," later and more comprehensive information leading us to believe that the consumption of this metal for a great variety of miscellaneous purposes is considerably greater than what we previously estimated. It is especially these consumers from whom it is most difficult to obtain statistical reports.

The particularly noteworthy feature about the statistics of consumption in 1908 is the deficiency of the total as compared with the deliveries, the difference being 37,285 tons. At the end of 1908 there were large speculative holdings of spelter, but the amount of such metal remaining at the smelteries was included in the stocks reported by the smelters, the inquiry having been specific in that respect. The difference between deliveries and consumption is to be explained by stocks in second hands, and in manufacturers' yards. It is well known that some of the latter had overbought their immediate requirements, and indeed the last report of the United States Steel Corporation contains a statement that it had on hand at the end of 1908 an increased quantity of spelter as compared with the end of 1907. The deliveries of spelter in 1908 did not fall off very largely as compared with 1907, but the actual consumption was only about 80 per cent. of that of the previous year. There was actually a decrease in the accumulated stock at the smelteries, but there was a large increase in the invisible supply. This situation was, of course, the explanation of the sluggishness of the spelter market during the first quarter of 1909, at which time less than 70 per cent. of the retorts of the smelters of ore were in operation. Since that time there has been a healthy improvement in the demand.

Seismic Disturbances and Colliery Explosions

We have been criticized in the last issue of *Mines and Minerals* for publishing an article in the JOURNAL of Feb. 20, 1909, favoring the theory that seismic disturbances are often accompanied by outflows of gas into coal mines. We did not indorse this theory, but in presenting the article by Mr. Spalding, made some editorial remarks about it as follows:

"An argument on the basis of *post hoc*

ergo propter hoc is inconclusive. Nevertheless, it must be admitted that the coincidence between earthquakes and colliery explosions is such as to warrant careful study of the conditions. In this connection, full credit must be given to James T. Beard, who has for many years been drawing attention to the matter, as the readers of the JOURNAL are well aware. . . .

"This, together with the atmospheric theory, that we have previously discussed, continues to demand the careful attention of colliery engineers. Our propaganda as to the probable effect of atmospheric conditions has led many operators to install barometers at their mines and observe them carefully for warning of approaching low pressure. Such warnings are generally recognized in Europe as being of great practical benefit."

The fact that Mr. Spalding's article had previously been declined by our esteemed contemporary lends no force to the argument that we should not have accepted it. Indeed, we are free to confess that this circumstance did predispose us to the idea that the manuscript might contain something of modern interest. We were fully informed of the history of the manuscript by Mr. Spalding in his first letter, wherefore *Mines and Minerals* need not worry about its veto having been unknown to us. In justice to Mr. Spalding, we shall say now that a large part of his original manuscript was devoted to an elaborate thesis in support of his argument, in which he advanced an interesting hypothesis. We asked him to withhold this portion of his manuscript until further researches could be made and additional proofs presented; and we confined his article to the coincidences between the records of seismic disturbances and the occurrences of colliery explosions. We stated very plainly in our editorial remarks that any *post hoc* argument is inconclusive, but urged that the coincidences have been such as to warrant study of the conditions.

The criticisms of *Mines and Minerals* are not of a character to cause us to recede from this position, which has the indorsement of numerous engineers and scientists in Europe and America. Indeed, there are many who take a far more advanced stand. Thus, Mr. Beard, of Scranton, who needs no introduction to the readers of *Mines and Minerals,* and who is recognized as an expert on the subject of colliery explosions, in his recently published treatise on "Mine Gases and Explosions" strongly advocates the earthquake theory; and at the recent meeting of the Meteorological Congress at St. Petersburg this subject was specifically under discussion, and several delegates suggested that a seismograph be installed at every mine to record earth movements and thereby warn engineers of the possibility of danger.

The JOURNAL aims to lead the way, and by bringing to the attention of its readers suggestive ideas seeks to develop profitable investigations that will elucidate the truth. The sooner we can discover whether barometric pressure, seismic disturbances and other natural phenomena have a direct bearing on the outflow of gases into mines, the fewer unsolved problems in connection with promoting safety in coal mining will there be. The journal that travels the beaten track will arrive only where others have been. Cristopher Columbus had difficulty in convincing the scientists of his day that the earth was round. Every town can produce its citizen who has been consistently opposed to every new idea—street cars, telephones, etc.—and Scranton is undoubtedly one of those towns. Fortunately the mining industry has in the ENGINEERING AND MINING JOURNAL a forum that is freely open to rational discussion.

Extension of Oil Production in California

Notwithstanding the large production—just now overproduction—of petroleum in California, there is plenty of exploration for oil going on. In May there were 462 wells being drilled in the State, and some of these are in new districts or extensions of old districts. Thus a syndicate organized by the head of the Santa Fé railway's oil department has taken over the lands of the Western Mineral Company, comprising 4000 acres of the flat southeast of Sunset. Under the agreement of purchase about $100,000 is to be spent at once in development. One corner of the ground reaches the Johnson holdings where a strong well was recently brought in. The Kramer Consolidated Oil Company at Kramer on the Mohave desert has met oil seepages at a depth of 2900 ft.; there is also an abundance of gas. This is a new territory.

In San Francisco and Los Angeles there is at present very little speculation in oil stocks, those owing shares in producing wells not caring to sell while dividends are being paid. When once the value of an oil well is established there is little uncertainty except as to the life of the well.

A Mining Code for Arizona

At the Territorial legislative session this year, several bills were introduced for the creation of the office of Territorial mine inspector. Out of this proposed legislation grew a proposition for a mining code commission, to be appointed by the Governor, to prepare and draft a code of laws regulating metalliferous mining. This commission has now been appointed, consisting of Will L. Clark, of the United Verde Copper Company, as chairman, together with Hon. Thomas Armstrong, Jr., an attorney-at-law of much experience, W. F. Staunton, general manager of the Development Company of America, and Messrs. Kipple and Kimball, who are thoroughly experienced underground miners. This commission expects to report at the next session of the legislature, and in the meanwhile will coöperate with the Committee on Prevention of Mine Accidents of the American Mining Congress. It is gratifying to observe that the seed sown by the latter is thus early beginning to bear fruit.

The Longest Pipe-line

Pipe-line connections have been completed by which it is possible to pipe oil from the Oklahoma wells to New York harbor. Oil has been started on the long journey of 1500 miles, but it had not reached the seaboard yet this week. This is the longest pipe-line in existence in the United States, and indeed in the world. It is not probable that much oil from the Mid-continent district will be brought to the seaboard at present, and the completion of the line seems to be more in the nature of a provision for the future, or for emergencies which may arise. Oklahoma has the most active oilfield in the country at present; moreover its production is increasing, while that of Pennsylvania and West Virginia is decreasing. It may not be long before the western wells will be called upon to supply the seaboard and export demand.

Amalgamated Copper Company

The statement issued by this company for the year ended April 30, 1909, gives the general balance sheet at the end of the year as below:

Investment in securities, etc., representing ownership in copper mines, mining claims, mining plants, reduction works, refineries, coal mines, sawmills, standing timber, water rights, land, etc	$156,481,847
Loan to Washoe Copper Co., for smelter construction	7,200,000
Cash and cash assets	3,593,102
Total assets	$167,274,949
Capital stock	$153,887,900
Accounts payable	22,565
Dividend No. 39, payable May 31	769,439
Surplus and reserve	12,595,045
Total liabilities	$167,274,949

The stock authorized is 1,550,000 shares of $100 each; of which 11,121 shares are unissued. The income statement, as deduced from the balance sheet, is as follows:

Net income for the year	$ 3,663,980
Dividends 36, 37, 38 and 39—2 per cent. in all	3,077,758
Surplus for the year	$ 586,222
Balance from previous year	12,008,823
Total surplus	$12,595,045

The statement says: "The producing companies controlled by the Amalgamated Copper Company, have been operated continuously throughout the fiscal year, with the exception of the Anaconda Copper Mining Company and the Boston & Montana Consolidated Copper and Silver Mining Company. The former was compelled to cease operations for a short period of time at the Washoe reduction works, due to the fact that the railroad companies were unable, on account of severe climatic conditions, to transport a sufficient supply of coke; and the reduction works of the Boston & Montana Mining Company at Great Falls were closed from early in June until the middle of September, on account of damage by flood to the power plant of the company and to the railroads, which transport the ore.

"The copper business, during the period covered by this report, has been dull and the ruling price of the metal has been low. During most of the year, the production ran in excess of consumption, but at the present time deliveries of the metal are about equal to the production. Sales have been made in sufficient amount to practically absorb the accumulated surplus, made in the early part of the year.

"All conditions in the Butte camp during the year, tending toward the successful operation of the different properties, have been quite satisfactory, and the cost per pound of copper produced has been materially lessened. The normal amount of development work has been carried on in all of the properties, and the officials of the different producing companies report that this has been done with very satisfactory results and that in several of the mines, new orebodies have been found at depth, which had never been encountered on the upper levels.

"The fire in the Anaconda mine, which has been burning for a period of 19 years, has occasioned some inconvenience from time to time, but has not interfered seriously with the operation of the property for any length of time.

"A new shaft on the Belmont claim, belonging to the Anaconda Copper Mining Company, has been put in condition and equipped, and will eventually be connected with the lower levels of the Anaconda mine. This when completed will be used as an auxiliary shaft for the operation of the Anaconda properties.

"The shaft at the Parrot mine has been sunk to a depth of 2000 ft. and cross-cuts to the vein have been made at the 1900- and 2000-ft. levels. While the vein at these depths shows ore of a concentrating grade, it is not equal to the average concentrating grade of the camp, and will not yield a profit at present prices for the metal.

"The Little Mina claim, owned by the Parrot company, has been developed by a shaft which has now attained a depth of 1200 ft., and a shoot of ore of good grade has been developed on the 1000-ft. level. Crosscuts are at present being extended toward the vein on both the 1100- and 1200-levels.

"The shaft at the Gagnon mine, owned by the Trenton Mining and Development Company, is now 2300 ft. deep, and the discovery of new orebodies on the lowest levels has increased the value of this mine.

"The improvements at the reduction works at Great Falls, consisting of a stack 560 ft. in hight, with flues and dust chambers, are practically completed, and will shortly be in full operation.

"The sawmills of the Big Blackfoot Milling Company have been operated to a greater extent than during the previous fiscal year, owing to the fact that the mines at Butte, on account of their constant operation, have required a larger amount of timber and the commercial demand, while still far below the average, is showing a gradual improvement.

"The coal mines at Belt, owned by the Anaconda Copper Mining Company, and the mines at Diamondville, owned by the Diamond Coal and Coke Company, have been operated continuously, with very satisfactory results, throughout the year.

"The developments at the Bear Creek coal mines, owned by the Washoe Copper Company, have also been most satisfactory, and a grade of coal is being produced, which compares most favorably with the best Wyoming coal.

"A considerable betterment has been made in the mining and reduction costs by the use of electric power. Electric pumps have been installed in the mines during the year and operated with good results, and it is planned to do hereafter all of the pumping in the mines with this power. Investigations are now being made to determine the feasibility and economy of operating all the hoisting plants of the different companies by compressed air, generated by electric power.

"The companies, owned solely or in part by the Amalgamated Copper Company, produced for the calendar year 1908, from their own and custom ores, about 234,000,000 lb. of refined copper, of which amount the Amalgamated Copper Company received the benefit from about 199,000,000 pounds.

Speculation in Copper

We have several times referred to the speculation in copper on the London Metal Exchange, emanating from this side of the water. This speculation is, of course, an old story with the metal houses having foreign connections, but during the last year it has been undertaken to a large extent by entirely outside interests. The latest development is the solicitation of such business by a well known firm of bankers and brokers. The following is part of a circular recently sent out by Hayden, Stone & Co.:

"We desire to call attention to the possibilities presented in the purchase of copper, the metal. Those who wish to buy copper, and do not care to be bothered with the details of handling it, will find it most convenient to buy copper warrants on the London Metal Exchange. Copper is dealt in there much as wheat and cotton are handled in this country. The metal is quoted in London in pounds per long ton, and the contracts call for delivery of what is known as 'G. M. B.' copper, a grade slightly lower than our electrolytic brand. The ordinary unit for trading is 25 tons. The usual contract is for three months, and the commission is ¾ per cent. for the round turn on the total amount of money involved. The contract may be renewed for a second three months on the payment of an additional commission of ½ per cent. The customary protection required is £5@6 per ton.

The stoping width on the South reef at the Roodepoort United mine has been reduced (*South African Min. Rev.*, March, 1909) from an average of 42 in. to under 30 in. The gold-bearing ore on this reef is only a few inches wide as a rule, and the company is now breaking about 25 per cent. less waste rock than it did formerly; also it is hoisting about 25 per cent. less, and, allowing for sorting, it is milling correspondingly less.

According to *Engineering-Contracting*, April 7, 1909, steam shovel No. 220, on March 2, working in the Empire Construction district, central division of the Isthmian Canal, removed 3941 cu.yd. of rock and earth in a working day of eight hours.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

The Smelter Smoke Question

For some years articles, more or less misleading, relating to alleged smelter-smoke damage, have appeared in various journals. No attempt has been made in the past to refute these statements, but with the conclusion of the Bliss suit, directed against the Anaconda smelter, in which the decision was sweepingly in favor of the company, it seems only just to call attention to misstatements of fact. The article appearing in the April number of the *Review of Reviews* is a case in point, and the astonishing position taken by the editor in refusing to correct errors makes it necessary to seek other channels of publicity. The correspondence submitted below requires no further comment:

EDITOR *Review of Reviews*:
Dear Sir:

In an article in the April number of your magazine, under the title, "Saving America's Plant Food," Guy Elliott Mitchell uses the following language:

"The Western phosphate beds may be considered of further importance by reason of their proximity to the great smelting works of the West—at Butte, Anaconda, Great Falls and other points. These smelters give off poisonous gases, chiefly sulphurous, that are very injurious to vegetation, *absolutely killing all green things for miles around*. It is found, however, that they can be utilized to great advantage by conversion into sulphuric acid, which is the agent used in reducing rock phosphate to superphosphate fertilizer, or, as it is generally termed on the farm, acid phosphate. Thus not only would a substance injurious to vegetation be controlled, but it would be actually employed in fostering plant growth."

I have too great respect for Mr. Mitchell to believe that he would knowingly indorse such a misrepresentation of facts as is contained in the paragraph quoted, and am inclined to think that he has accepted the statement of a prejudiced government official as being true. The following quotation from the opinion of Judge William H. Hunt, of the Circuit Court of the United States, Ninth Circuit, District of Montana, in denying a petition to enjoin the operations of the immense plant of the Anaconda Copper Mining Company, at Anaconda, after one of the most extensive hearings on record, will, I think, conclusively settle the question of the extent of the damage around Anaconda and adjacent country.

"Fortunately, I have been helped to a better understanding of much of the testimony in the record—indeed, of the whole case—by a visit of two days to the valley, during which time I rode many miles in an automobile in various directions from the smelter. The trip was made in August, 1905, in company with the master in chancery, counsel for complainant and defendants herein, and one or more expert witnesses for the respective litigants. As I had asked the several counsel to call my attention to anything they thought worthy of particular notice, it is fair to say that I had an excellent opportunity to gain a general, though, of course, somewhat superficial, insight into conditions. Upon the first day, which was bright, the smoke from the big stack rose high into the air, and seemed to be carried far away so high that its diffusion would seem to have been too general to do injury to any land; but on the second day the weather was rainy and the clouds were lower. The smoke then was more dense and its stream was carried down toward the Bliss ranch and southerly and northerly for a few miles toward the center of the floor of the valley, and was there dissipated. The trip impressed one main thing very firmly upon me, that neither the eye nor the training of an experienced or scientific agriculturalist was required to ascertain. It was that the allegation of complainant's bill, to the effect that the Deer Lodge valley and the country adjacent to the smelter are barren and desertlike, is grossly inaccurate. It is true that the land and vegetation lying within, say, a quarter of a mile of the smelter, is visibly affected. But outside of this limited area there was the appearance of healthy natural conditions of successful cultivation and of such crop growths as are usually seen in the valleys of the State. The harvest was going on; we saw hundreds of healthy-looking shade and fruit trees about farm houses; the grainfields and pastures looked as others in Montana generally do during or just after harvest. We walked over a portion of complainant's place, noticed the foxtail and inferior quality of the grasses growing, and, except for the smoke on the second day, there was nothing in the physical appearance of the complainant's farm or of the valley that indicated unusual or abnormal conditions."[1]

With reference to the use of sulphuric acid for the manufacture of fertilizers, freight rates are so high as to prohibit any such use of the acid for many years to come. In time, undoubtedly, when the extremely rich soils of the arid West, adjacent to phosphate beds, or near the smelters, shall have become exhausted, a market will exist comparatively near at hand, but until this time there will be no demand for a product that would be gladly furnished if it were possible to dispose of it.

The men in charge of the great smelters of the West are men of keen business discernment who are constantly seeking means of increasing the value of their output and of utilizing waste products. The "wise men from the East" come with ready-made solutions of the problem, but soon learn to appreciate the obstacles confronting the men who have grappled with and overcome even greater difficulties in the past, and who may be counted upon at the earliest possible moment to make a source of profit of that which is now going to waste.

F. W. TRAPHAGEN.

Golden, Colo., April 22, 1909.

[1]Pages 26 and 27 of printed opinion.

Prof. F. W. TRAPHAGEN,
Colorado School of Mines,
Golden, Colo.:

Dear Sir:

We have read with interest your letter of April 22 replying to a statement made by the writer of our article in the April *Review* on the Western phosphate beds. It does not prove possible, however, for us to print your letter, because there is no provision in any of the departments of the magazine for the printing of communications correcting or controverting statements made in previous issues. It is regrettable to have an erroneous statement made in any of our articles, but it is not quite feasible to devote any considerable space in a subsequent issue to a correction of such statement. We thank you very much, however, for allowing us to read your comments on the point in controversy, and would suggest that perhaps the author of the article in question might be interested in seeing what you say about the matter. Guy E. Mitchell may be addressed care of the Geological Survey, Washington, D. C. We return your letter herewith.

Yours very truly,
Editorial Dept., *The Review of Reviews.*

[There has been a great deal of absurdity published with respect to the smelter-smoke question. There has been no suggestion more absurd than the proposed utilization of the sulphurous smoke of Anaconda and elsewhere for the manufacture of sulphuric acid. We have pre-

viously referred to this in the JOURNAL. It is no matter for surprise that a non-technical journal should fall into the error of fathering such a recommendation, but it is indeed a source of regret that such a recommendation should have emanated from the U. S. Geological Survey, even if it be with respect to a matter that does not pertain directly to the geological studies of the Survey. Although the Government, evidently to "save its face," is now having this matter investigated by a chemical engineer who is qualified to express an intelligent opinion, we have no doubt that the latter will be substantially in accord with that of chemical engineers in general, although its phraseology may be tempered so as to pass delicately over some raw places. Amid the flood of absurdities and prejudice in connection with the smelter-smoke question, the work of Professor Traphagen has stood out eminently for its lucidity, rationality and scientific spirit.—EDITOR.]

The Quebec Mining Law

I beg to call your attention to page 1046 of your issue of May 22 in the article on the Quebec Mining Law, wherein you state that in order to obtain letters patent "an expenditure of $500 must be made for each acre purchased." The manner in which this phrase should read is as follows: "An expenditure of $500 must be made for every section of 40 or 100 acres purchased."

J. OBALSKI,
Superintendent of Mines.

Quebec, June 3, 1909.

A condensed statement of the terms of the new mining law of the Province of Quebec has been furnished us by Mr. Obalski, as follows:

THE QUEBEC MINING LAW AS IT STANDS

1. The mines are reserved by the Crown on all the Crown lands and on the lands sold or patented for farming or other purposes after July 24, 1880, the owner of the surface having no right whatever thereon except to the damages. The land needed for mining may be expropriated by arbitration process before the Department of Mines.

2. Gold and silver are reserved by the Crown on all the lands, whatever may be the date of the patent.

3. Surface and underground may form one property, but can be separated in order to form two distinct properties, according to the wish of the owner.

4. The whole Province, surveyed or unsurveyed, is open for prospecting, except on territory already alienated for mining.

5. The staking out of a claim can be done only and personally by a prospector holding a miner's certificate. The cost of such certificate is $10, good until Dec. 31 in each year.

6. The staking out can be done on claims having an area varying from 40 to 200 acres in unsurveyed territory and on specified lots, from one to two lots, forming a maximum of 200 acres. Within four months of the staking out a mining license must be taken: (*a*) On unsurveyed territory for the claim as staked out; (*b*) on surveyed territory for lots or fractions of lots, containing an area of from 1 to 200 acres.

7. In unsurveyed territory the claim must be rectangular in form, with north-south and east-west orientation; and in surveyed territory the mining license will be bounded by lines parallel to the outlines of the lots, and the description must be furnished to the satisfaction of the Minister.

8. No evidence of discovery, assessment works or surveying is required in order to secure a mining license, but a fee of $10 plus a rental of $1 per acre per year has to be paid in advance, and the same is renewable, so long as the necessary amount is paid to this department.

10. The mine may be purchased upon payment of $10 or $20 per acre, respectively, within or outside of 20 miles in a straight line from railroad in operation, the above being for a full claim or an entire 100-acre lot. The applicant must produce the proof of a mineral discovery, the concession has to be surveyed and an amount of $500 spent in mining work before the patent can be secured. On Crown land the surface is sold with the mine, and on private land only the underground property, part of the surface being liable to expropriation should same be necessary.

11. All applications and recording must be made through correspondence with the Department of Mines at Quebec until otherwise announced.

12. The prospecting license system has been abandoned, but the actual holders will keep the benefit of the same and will have the right to renew them until Jan. 1, 1910.

Guerrero and Its New Railroads

In the JOURNAL of April 24, 1909, I notice the following from the correspondent at Mexico City: "A notable state road has just been completed from the end of the central line at Balsas, Guerrero, to Chilpancingo."

It may be of interest to know that the road mentioned is to extend from Iguala on the Mexican Central Railroad in Guerrero to Chilpancingo, the capital of the State. The road is only about two-thirds completed but work is being rapidly pushed at several points and it is expected to be formally opened before the end of the year. I might add that the present administration of Guerrero, headed by Governor Don Ramon Flores, is one of the most progressive in the whole Republic. The above is but the beginning of a comprehensive system of roads, proposed by the administration, covering the entire state. It is probable that this road will be put through to the coast at Acapulco in the next few years.

A similar road from Iguala to the old mining center of Taxco, is nearly completed. These are not "roads" in the ordinarily accepted sense. The road from Iguala to Chilpancingo is 14 ft. wide, rolled with crushed stone, and having maximum grades of 4 to 4½ per cent. In the low country the road is protected by well constructed ditches and in the higher sections by masonry culverts. The construction throughout of the road is in accord with the latest scientific practice.

Guerrero is a state of vast possibilities in her undeveloped mineral resources, to the development of which the lack of transportation is the chief obstacle. The building of these roads, and the liberal attitude of Governor Flores and his administration toward foreigners is a direct invitation to foreign capital.

SUBSCRIBER.

Campo Morado, Guerrero, May 22, 1909.

The "Consulting Engineer" and a Question of Ethics

In the JOURNAL of May 29 a "Subscriber" inquires as to the ethics of a certain transaction involving a question of professional ethics, upon which the JOURNAL made some comments. The latter were quite right upon the basis of the facts as stated. Although no names were published, and there is but little by which to identify the occurrence about which "Subscriber" wrote, I think that I am able to connect it with certain transactions and am in a position to state that the actual facts were in no way as represented by "Subscriber."

X. Y. Z.

New York, June 4, 1909.

[Our comments in the issue of May 29 were based, of course, upon a certain statement of facts. It should be needless to say that they do not apply to any other condition of affairs.—EDITOR.]

According to figures collected for THE MINERAL INDUSTRY, based on reports of all producers, the 1908 domestic output of lead products was as follows: White lead, 116,628 short tons, worth $10,515,315, against 111,409 short tons, worth $12,254,990, in 1907; sublimed white lead, 9100 short tons, worth $1,156,282, against 8700 short tons, worth $1,026,600 in 1907; red lead, 11,358 short tons, worth $1,156,282, against 13,370 short tons, worth $1,778,717 in 1907; orange mineral, 393 short tons, worth $43,157, against 815 short tons, worth $123917 in 1907; litharge, 12,254 short tons, worth $1,231,206 against 14,769 short tons, worth $1,624,553 in 1907.

Conservation of Natural Resources

Progress in Mining and Metallurgy of Iron and Copper. Greatest Waste Is in Use, Not in Production. Engineers and Corporations Defended

BY JAMES DOUGLAS*

In discussing the waste upon which hinges, or is supposed to hinge, so largely the preservation of our national resources, the conclusions reached would be more reliable if actual experience were consulted, and fewer deductions were drawn from general statements, which are often the product of the imagination.

It cannot be questioned that the value of by-products has not been sufficiently appreciated by us, and that our tardiness in recovering the useful ingredients of the escaping gas of our coke ovens is one of the most glaring instances of shortcoming in that direction. And yet even for that sin there is some palliation in the immature condition of affiliated industries. I presume that it is admitted, without argument, that, except under very exceptional conditions, all the elements cannot be recovered from most of the ores or natural products which we treat. While it is a shame that the by-products from our coke ovens should be dissipated, Edward W. Parker's report to the U. S. Geological Survey for 1906[1] supplies a fairly good excuse in justification of this appalling waste. He says (pp. 773 to 774):

"What has been already commented on in previous reports about the slowness of manufacturers to change from the better known but wasteful beehive practice to the by-product-recovery method of coke manufacture is particularly emphasized in the statistics presented in this chapter. For it would appear from the table following that the construction of by-product ovens had about come to a standstill, especially when the records for the preceding five years are taken into consideration. * * *

"One of the reasons that has been assigned for the comparatively retrogressive condition exhibited by the statistics for 1905 and 1906 * * * is the lack of a profitable market for coal tar, and yet the United States is importing coal-tar products to the value of several million dollars annually, while the development of the fuel-briquetting industry has been held back because of the lack of assurance of a steady supply of coal-tar pitch for a binder, and users of creosoting oils for the preservation of timber complain of an insufficient domestic supply of this product of coal-tar distillation."

NOTE—From *Bull.*, A I. M. E., May, 1909.
*President of Phelps, Dodge & Co., New York.

[1]"Mineral Resources of the United States," 1906, U. S. Geological Survey, Washington, 1907.

The truth is that one branch of industry is so dependent upon another that there must be equal progress along the whole line of industrial life, if complete recovery of all the available elements of our natural resources is to be effected. The chemical industry must keep pace with the mining and metallurgical industry. We may be moving too slowly in that direction, but we can distinguish a steady movement toward this needful cooperation. It is encouraging, for instance, to find that the waste gases from the furnaces of the Tennessee Copper Company are being turned into sulphuric acid for the manufacture from Southern phosphates of the superphosphates which the fertilizers of the Southern cottonfields need. Failing this mutual relation between the metallurgist of Tennessee and the chemical manufacturer, the blame should not rest entirely upon the metallurgist for wasting that for which, heretofore, he has been unable to find a market. The same justification exists abroad as in this country for similar waste in other branches of industrial activity.

Recovery of By-products by Legal Compulsion

It is nevertheless true that legal compulsion alone has driven manufacturers to introduce improvements and economies which were demanded by public safety, and which have redounded to the benefit of the reluctant corporations. In Germany and England the disposal of noxious vapors and noxious liquors has been required of the manufacturers, but their compulsory removal from the atmosphere and the water has resulted in their conversion into useful products, and the building up of new technical industries. An agitation is springing up in the West against the fumes from smelting works being turned loose into the atmosphere. While in some cases the injury done to vegetation may have been falsely attributed to the smoke from metallurgical works, the agitation has been followed by some good results. For instance, the Mountain Copper Company, having been driven out of Shasta county, Cal., by the farmers, has erected chemical works as an annex to its smelter at Martinez, on San Francisco bay. Here, as elsewhere, manufacturers are reluctant to go to the heavy expense involved in abating such nuisances, even though they may know that in the end the abatement will be profitable. As far back as 1881 Mr. Vivian admitted that in recovering 47 per cent. of all the sulphurous acid emitted from his furnaces in Swansea, he condensed 3666 tons of oil of vitriol at a great profit. This valuable asset, though he does not so state, was secured in spite of bitter opposition on the part of those who were ultimately the most benefited by it. One looks with wonderment at the clouds of valuable fumes which float from the New Jersey shore over Staten island to the sea instead of flowing inland as acid to the chemical manufacturers in the neighborhood.

Our industrial development, however, has reached such a state of advancement, especially in the densely-populated portion of the country, that however averse some of us may be to expend a large share of our profits in improvements, designed primarily to relieve the public of nuisances, we must submit whether we will or not. And having obeyed the mandate of the law, not many years will elapse before we come to realize that what we do under compulsion is as much for our own good as for that of our neighbor.

Early Experience in Arizona

I promised, however, to confine myself in my remarks to matters of experience. I have been identified with the copper interests of the Southwest since 1881. Though the Southern Pacific railroad had only just traversed the territory, mining was immediately stimulated by railroad transportation, and the Copper Queen, at Bisbee, the Old Dominion, at Globe, and the Lezinskys (the predecessors of the Arizona Copper Company) as well as the Detroit Copper Company, were actively at work at Clifton. All three of the most productive districts, therefore, of southern Arizona were being explored, and, through the influence of the railroad, vigorously exploited, at that time. But none of them were situated on the main line, or were linked to the trans-continental road by branches. The Copper Queen was 60 miles from its nearest railroad station, Benson; the Old Dominion was 140 miles from either Wilcox or Bowie; and the mines of the Arizona Copper Company, and the Detroit Copper Company, were 80 miles from Lordsburg. Coke and supplies had to be hauled in and copper teamed out those long distances.

The ores in all three camps were thoroughly oxidized. At the time this was supposed to be a condition of the highest advantage, upon which the only possibility of economical treatment depended; and not without good grounds,

for the tedious methods of treating sulphide ore, so expensive in labor and fuel, were still practiced. We all, therefore, imagined in our shortsightedness that the day of doom for the copper interests of southern Arizona would date from the transition from oxidized to sulphide ore. Of the three districts, the only prosperous one during the succeeding 15 years or so was the Warren, and for reasons which we now more clearly appreciate than we then did. The ores of the Copper Queen, or rather such of them as were then selected for treatment, were self fluxing. They contained about 10 per cent. of copper. The slags of that period, which we are now resmelting, contained about 2.5 per cent. of copper. Assuming the slags to represent 65 per cent. of the charge, about 16 per cent. of the total copper content was being stored away in them. Less favorable conditions, however, existed at both Globe and Clifton. The ores of both these districts were extremely silicious, and the furnace charge of ore had to be diluted with from 40 to 50 per cent. of limestone. The silicious ores as treated were probably of about 12 per cent. The furnace charge was reduced by fluxing to between 7 and 8 per cent. of copper. The old slags—65 per cent. of the total charge—yield at Globe about 3.5 per cent., and therefore must have carried from 30 to 32 per cent. of the total copper fed into the furnaces. We have re-treated all the old slags of the Detroit Copper Company, at Morenci, near Clifton, and know that they carried on an average 4.5 per cent. of copper, and must, therefore, have contained at least 40 per cent. of the copper in the ore. At neither Clifton nor Globe was the dust collected, which probably represented a loss of another 5 per cent. Considering the high cost of fuel and labor, it is not to be wondered that neither the Old Dominion, the Arizona Copper Company, nor the Detroit Copper Company, was financially successful for the first 15 or 16 years of their existence. It was not until all the richer carbonate ores had been wasted by being largely converted into slags that the companies recognized that their salvation depended upon securing sulphide ores; upon making metallic copper through the medium of matte, and throwing away less copper in their slags. So little, however, was this fact appreciated at first that we all envied the Arizona Copper Company, because it could turn the San Francisco river into its works and granulate and wash away this valuable refuse. And when the Old Dominion mine struck large volumes of water, the company committed the same act of folly, washing its 3.5-per cent. slags into Pinal creek.

Deficiency of Sulphide Ore

Had the companies realized the losses they were incurring and the only remedy applicable, they would have been obliged to close both mines and furnaces; for except at the Copper Queen, where sulphide ores were encountered within three or four years after the mine was opened and were considered a nuisance, heavy sulphides are elsewhere rare. Though the Old Dominion Company has explored its property to the 16th level, between 100 and 200 tons daily are imported from California and Bisbee, the company's own mines producing only about 60 per cent. of the sulphur required by the furnaces. And at least one of the Clifton smelting companies is obliged to draw from abroad by railroad about 160 tons daily of sulphides high in sulphur and low in copper. It follows, therefore, that there was no alternative in the early days between either suspending operations or making copper in the wasteful manner which the companies then pursued.

Looking at the situation from the standpoint of today, if we place the advantages and disadvantages side by side, we have on the side of the advantages:

1. The experience which was gained during that long period of adversity, which is now being turned to good account, not only by the original companies, but by the many other enterprises which have entered the same field and are profiting by the losses of the pioneers.

2. The southern portion of the Territory has increased in population and in wealth, mainly through the exertions of these copper companies, even while they were losing money on the copper produced. They not only employed thousands of men, but they made a market for the agricultural development of the small amount of arable land within reach of the mines. Had the mines of Globe and Clifton not been operated because pecuniarily unsuccessful, and had not the shareholders been willing to accept hopeful promises in lieu of dividends, Arizona would not today be making an unanswerable plea for admission to the Union as a State.

3. The ultimate success has been due to the advent of the railroad; for railroads are seldom built into unproductive regions in the expectation of creating traffic that does not exist.

Advantages of Progress

If we turn to the disadvantages, they are, of course, palpable. At the present time, when we are matting our copper ores instead of making black copper direct, the slags from those three groups of copper furnaces run from 0.4 to 0.5 per cent. of copper. Even when the slags are re-treated, copper in the slags resulting from the slag treatment runs higher than in slags from the treatment of ore, owing to the difficulty of reducing silicates. Thus, when the slags are re-treated, there is the double waste of fuel and the double waste of labor.

Even supposing that our economic system were different, and that necessity did not drive public corporations to utilize wastefully the resources they acquire, I think that the balance of advantage to the country at large, as well as to the district, would indicate that it is better to make progress and thereby gain experience, even at the expense of such waste as I above indicate, rather than stand still and do nothing, in the hope of more favorable conditions being brought about by Providence rather than by our own efforts.

Never Throw away Slag or Tailings

Certain lessons, however, the above recital of experience teaches. One of them is, never to throw away anything that contains material of any value, even though it may seem to be valueless. The time inevitably comes when, through improved conditions or better methods, what was waste to one generation becomes of value to another. Most of the filling of the old stopes in the Copper Queen mine and in the Old Dominion mine has already been re-treated. In the case, therefore, of sulphide ore, which is too lean to handle, it should be stored underground rather than exposed to the weather at the surface. I am not sure whether we are justified in ballasting our railroads with the slags which we are making now—lean as they are. One cannot see how 0.5 per cent. of copper and a little gold and silver can possibly be recovered to any advantage, and yet the future may reveal secrets which will convert such impossibilities into possibilities. The slags from the iron blast furnaces, which were deemed valueless a generation ago, are made into hydraulic cement today.

We all recognize the waste that has resulted in the past from washing away gold tailings, which often ran several dollars in gold to the ton. Had they been impounded, the minerals now, through weathering, would be in the fittest possible condition for cyaniding, and would give up to this process their residual values to within a trifle of their contents. The same rule of preservation should be applied to the tailings from copper works. The sulphides, no matter how small their percentage, slowly decay, and give off their copper as soluble sulphate, which can be precipitated on scrap iron at a very inconsiderable cost. If the locality be such that these waste materials can be stored, care, and some outlay, if necessary, should be expended in their preservation.

Waste in Domestic Life

There seems, however, to be a fascination in contemplating loss rather than saving, and while we cannot exaggerate the follies of waste, it is not fair to the profession to overlook the efforts that have been consistently made within the last three-quarters of a century, and are still being made, to eliminate waste. One of the anomalies, however, of the problem is that the accused mining and technical engineers compose the only section of the

public which really appreciates the cost of waste and tries to save.

The recovery of heat units in our domestic fireplaces and furnaces is far less than the recovery of heat from coal burned under our best boilers, when measured as power generated in our steam engines. And the waste in our kitchens and at our tables involves a greater national loss than the waste in our coal mines. In the one case the people at large are making no effort to minimize it, while every technical man of repute is putting his best endeavors into devising means of getting the highest efficiency out of nature's forces, with a view to turn nature's resources indirectly to the greatest good for the greatest number.

If we look backward to what has happened within our own day and experience, we may justly feel some resentment at the harsh criticism which is now being so generally aimed by the press and the public at technical men. And this is partly true likewise of the strictures so indiscriminately passed upon the corporations which are instrumental in developing the country's natural wealth.

Advances in Iron Manufacture

In the middle of the last century, less than one-half of the iron made in this country was smelted with anthracite, and the balance with charcoal or charcoal and coke.[2] The devastation of the forests was awful. Pearse[3] gives the consumption of wood in Berks county, Penn., in making 19,000 tons of charcoal iron in 1828, 1829 and 1830 at 250,528 cords. To secure this amount about 8000 acres of the finest forest land in the country must have been stripped. In England, where most of the iron was made with coke as fuel, at the same date, and until 1875, there were consumed from 35 to 37 cwt. of coke per ton of pig iron. In 1875, when the Whitwell stove was introduced to heat the blast, the quantity of fuel consumed was reduced by 3 or 4 cwt. By improved mechanical and metallurgical appliances that consumption in the Middlesbrough district is now lowered to 22 cwt.[4]

This saving of fuel in the blast furnace has, in this country as well as in Europe, been effected through the sleepless activity of metallurgists and engineers, by modifying the size and shape of the great iron stacks, increasing and regulating the temperature and the pressure of the blast, and by the introduction of appliances for utilizing the waste heat. The difference between the 37 cwt. of coke formerly needed to make a ton of pig iron and the 22 cwt. now consumed, multiplied by the number of tons of pig iron made in the United States in 1906, represents a saving (assuming 1.75 tons of coal as required to make 1 ton of coke) of approximately 30,000,000 tons of coal.

Bessemer and Gayley

The progress along this line in blast-furnace practice has been steady and wonderful, and has culminated in the ingenious device of James Gayley, which still further economizes fuel, by freezing the blast before admitting it to the stove in order to eliminate moisture, and thus supply the stack with a gaseous element of as constant and reliable a composition as the solid elements of fuel and ore.

The advances in blast-furnace practice in the direction of fuel-saving have been great. But they are not as startling or as picturesque as the economies which followed the introduction of the pneumatic method as applied through the mechanical and metallurgical skill of Bessemer, and as developed in the United States through the genius of Holley. We can all recollect the distressing sight, especially in summer weather, of the puddler, stripped to his waist, toiling over his furnace, while burning up from 20 to 27 cwt. of coal, in converting 1 ton of pig iron into puddle bar. Leaving out of the question the fuel used in generating the power for operating the bessemer converters, which, however, is generally recovered from the waste heat of the blast furnace, the amount of coal saved in making bessemer steel instead of wrought iron during the same year of 1906 exceeded 22,000,000 tons.

The Metallurgy of Copper

The metallurgy of copper has benefited as acutely as the metallurgy of iron and steel from the combined science and skill of the mechanical and metallurgical engineers. One recollects distinctly how, in the old brick furnace, a campaign of 10 days, with a daily charge of 10 tons of ore, was looked upon as almost phenomenal; and that from the time we began roasting sulphide ore in heaps until the refined copper was turned out after endless handlings of the mattes, as they were worked up from lower to higher grades, about three months was occupied. Now, by means of mechanical roasting furnaces, large jacketed cupolas, electrical cranes, the bessemer converter and the Walker casting table, the ore is turned into metal in fewer hours than it formerly took weeks, and at the same time almost dispensing with hand labor.

While these industrial changes were going on in the mining and metallurgical fields, the electrical engineer was bringing under control that tremendous force which Faraday investigated as dynamic electricity; and we metallurgists have not been slow to apply it, both to the saving of fuel and other natural resources, and to the conservation of human labor. The modern rolling mill, in which a motor replaces the small engine and boiler that used to operate the rolls, and the modern electrolytic plant which turns out electrically pure copper, are only the more visible benefits that electricity is conferring. When some of us commenced our technical experience, the deduction in precious metals made by the refiner of copper before any contribution was made to the miner or the seller, was $60 worth per ton of ore or metal. Under such heavy charges comparatively small amounts of gold or silver were or could be saved. Today, through the application of electrolysis to the metallurgy of copper, about $8,000,000 in value, which was formerly lost, is now recovered annually and goes into commerce as a by-product; for the world's copper may be assumed to carry an average of $10 per ton in gold and silver.

Electrical Transmission of Power

The last aplication of this mysterious force, by transmitting from stationary engines electric current for the movement of trains, aims at reducing what is certainly one of the most wasteful uses of coal—its consumption in the locomotive for the generation of steam. In distributing our coal supply, the railroad burns from 20 to 25 per cent. of the total production of our coal mines. This will be notably reduced, though to what extent has not yet been determined. But before this desirable consummation is attained, if electrical engineers continue to extend the limits within which long-distance transmission can be applied economically, they will bring the latent, neglected forces of the whole continent to our doors, and the water powers 1000 miles away, as well as the winds and tides, will propel our railroad cars as well as heat our houses. The service which coal now performs will be fulfilled without the expenditure of human labor and the diffusion of so much obnoxious smoke and vapor. Long before our coal supplies are exhausted, even on the most pessimistic calculation, our children will gladly leave the balance in the ground, and charge off to profit and loss some of what we now consider our most valuable natural asset.

Destruction of Forests

There is no doubt whatever that the destruction of our forests is attended by a host of such terrible consequences that a halt must be called. In the early days at Bisbee, when we were at a distance from the railroad, we, of necessity, almost stripped the hills of their scanty clothing of stunted wood, for we were forced to use wood for the generation of steam. I find from one of the earliest statements that the company burnt about 4000 cords of wood for the year. The hills for miles around were completely denuded, with the result that disastrous floods have ever since almost annually de-

[2] In the *Iron Manufacturer's Guide* (1866), Lesley gives the total production in 1854 at 724,833 tons, of which 417,123 tons was charcoal- or charcoal-and-coke iron.

[3] "Concise History of the Iron Manufacture," p. 156.

[4] "A Description of Messrs. Bell Brothers' Blast Furnaces from 1844 to 1908," and other papers. *Journal of the Iron and Steel Institute*, Vol. LXXVIII, No. III, 1908.

luged and damaged the town, which is built in the troughs of two converging valleys. As mining engineers we are sensible of the ruin which reckless lumbering involves, and we lower with regret every stick of timber that we bury underground. Nor are we satisfied to bemoan the fact without making some effort to remedy the evil. It has been suggested, and we are trying the experiment, to replace wood by iron. The forests can be restored in time by reforestration, but iron ores cannot be replaced. And, therefore, it is a false economy to attempt to save a reproductive material by substituting one which rusts and cannot be regenerated. Concrete is also being used more and more in mining operations, and against its substitution for wood there can be no objection; but the most notable economy will result from improved methods of mining, especially from the introduction of the caving and slicing systems.

The Caving System of Mining

These were introduced into the Cananea mines when Arthur S. Dwight was manager; and Doctor Ricketts and Mr. Kirk have extended the use of the methods and applied them so successfully that less than half the timber is used per ton of ore extracted today than was buried in the mine three years ago. The following table, kindly supplied by Doctor Ricketts, represents the saving which is going on at Cananea, and in many mines where the same method is applicable:

TIMBER CONSUMED PER TON (WET) OF ORE PRODUCED AT CANANEA, MEX.

Period.	Tons Ore Mined.	Feet Timber Used.	Feet per Ton.
Aug. 1, '05, to Jan. 31, '06	463,039	10,774,342	23.27
Feb. 1, '07, to July 31, '07	554,473	8,268,682	14.95
Aug. 1, '08, to Sept. 30, '08	97,510	1,091,837	11.30

While it would be presumptuous to pretend that, as a people, we are economical, and to deny that, under modern corporate control of large national resources, the temptation, under necessity of making large profits, is not betimes stronger than the appeals which conscience makes to subordinate personal gain to the national welfare, I am sure that neither our largest mining and metallurgical companies nor ourselves, as their working agents, are recklessly indifferent to the preservation of those very materials upon which the wealth of the corporations and our own salaries depend. No large corporation would today use an old boiler and slide-valve engine with a consumption of 6 lb. of fuel per h.p.-hr. in preference to a triple-expansion, cut-off engine which will do the same work with 1.5 lb. per h.p.-hr., and so on through the whole gamut of operations which these large corporations conduct and which we, as their managers, advise them to adopt, because we believe them to be the best and most economical methods.

Corporations Unjustly Blamed

While public policy may not be the prime motive for saving, every thinking man in a large institution, from the manager downward, takes a pride in knowing that he is saving, and feels a sense of shame when he is conscious of wasting. And in economic life—I do not speak of social and domestic life—the rules against waste are becoming more and more rigid and are better enforced. The public outcry, therefore, against the large corporations for wasting the natural resources of the nation is unjust in so far as it fails to recognize what they have done and are doing in the direction of conservation, and inasmuch as it gives the working staff of these great corporations so little credit for the marvelous progress the world has made through their instrumentality. They have saved where formerly, through ignorance and inexperience, their predecessors were wasting. With more profound knowledge, and better instruments for observation and investigation, they are patiently unraveling nature's secrets and learning how to turn her forces to human uses. I cited a case of the unavoidable waste of copper ore, of fuel and of human labor in the treatment of the oxidized copper ores of Arizona 20 years ago. The men who were wasting acted upon their knowledge and skill. So now it often happens that in response to the urgent call which modern society makes by fits and starts for enormously increased productiveness of various commodities, the demand can be met only at the expense of waste of nature's resources, of human energy, and even of human life. If a more stable balance could be maintained between supply and demand; if the current of domestic and economic life would run more smoothly; if wealth were not accumulated so easily and spent so lavishly; if those marvelous improvements to which we have referred were not periodically made, which give these irresistible impulses to world-wide human energy, thereby bringing about these oscillations between hard times and good times, between labor dearth and labor surplus; if all these disturbing elements were obliterated, certainly there would be less waste, and possibly there would be more happiness. But it is not our part nor within our power, as mining and metallurgical engineers, to reconstruct society or renovate the world. Yet it is our duty to continue using our best efforts—whether the world recognizes our merits or not—to get the utmost energy out of human life as well as out of the inert material we handle—with the least possible exhaustion of human tissue and the smallest possible waste of mineral or vegetable material.

According to *Stone,* all the marble used on Argentina's new government building at Buenos Ayres will be cut with carborundium wheels made here.

The Zinc Corporation

Special Correspondence

The report of the Zinc Corporation, Limited, for the 10 months ended Dec. 31, 1908, states that of the period under review, the first two months were employed in construction and the following three months in experimental mining and adjustment of the plant, during which time the working expenses were necessarily high and returns less than in the latter portion of the year.

The total revenue from the concentrates made and from sulphuric acid sales, etc., was £136,398. The prices at which the metals were sold were: Spelter, £20 3s. 2.6d.; lead, £13 6s. 7.8d. per ton; silver, 24.387d. per oz. The latest monthly results recorded are those of April, 1909, when 18,090 tons were treated yielding products valued at £19,065, taking spelter at £20. The month's expenditure was £8352; the cost of material treated, £4523, and the estimated profit, £6190.

The directors refer to a convention that has been arranged between the large smelters to limit production of spelter and hope that thereby improved prices will be obtained in the future. In the profit-and-loss account a profit on the year's operations of £25,504 is shown. There was, however, a debit balance from the previous year's accounts of £85,154, which is now reduced by the profit shown above to £59,650.

The report of the general manager gives statistics of the technical results obtained. A total of 131,965 tons of material (Broken Hill tailings) averaging 20.14 per cent. zinc, 5.69 per cent. lead and 8.47 oz. silver were treated for a yield of 47,312 tons of zinc concentrates, assaying 46.35 per cent. zinc, 7.3 per cent. lead and 15.55 oz. silver, and of 2503 tons lead concentrates, assaying 57.3 per cent. lead, 16.3 per cent. zinc and 38.66 oz. silver. The total extractions work out at 84 per cent. of the zinc, 65.3 per cent. of the lead and 74.4 per cent. of thesilver.

The working costs from August to December averaged 9s. 4d. per ton. Further improvements in extraction and costs are expected as greater experience is gained.

The Elmore concentrates produced during the period had an average assay value of 43 per cent. zinc, 16 oz. silver and 10.1 per cent. lead. These concentrates, at the average metal prices ruling for the period, were worth 36s. per ton. After being passed through de-oiling furnaces this product was separated into zinc concentrates and lead concentrates. The value of these final concentrates was 49s. 4d. per ton of original Elmore concentrates, thus showing that these latter concentrates were enhanced in value to the extent of 13s. 4d. per ton by the separation. Photographs of the works accompany the report.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

E. Dedolph, of Nelson, B. C., has been visiting New York.

Herbert Haas, of San Francisco, has gone to London, on professional business.

S. S. Fowler, of Nelson, B. C., attended the commencement exercises at Columbia University last week.

George R. Stilwell, manager of the Hewitt mine, Silverton, Slocan, B. C., has returned from a trip to England.

Ernest Schmatolla, of London, sailed for New York, May 29. He expects to pass about three months in the United States.

A. E. Drucker, metallurgical engineer, of Aberdeen, Wash., is now in New Zealand, visiting some of the gold-mining districts there.

E. W. Brooks, of Los Angeles, Cal., is now in Seattle and intends to sail shortly for Alaska to examine copper prospects for Seattle people.

J. S. McCord, of Philadelphia, accompanied by a party of capitalists from that city, recently inspected several of the principal mines at Cobalt, Ontario.

James T. Dixon is now general manager of the Vezeeroff-Stanley mining concession, his headquarters being at Salairski Rudnik, in the government of Tomsk, Siberia.

Professor U. S. Grant, of the Northwestern University, has sailed from Seattle for Valdez to study glaciers and the gold and copper prospects on Prince William Sound.

D. G. Wilson, for several years superintendent of the Bankhead colliery, near Banff, Alberta, has been transferred to the Hosmer mines, British Columbia, in a similar capacity.

Herbert C. Hoover, who has been to Korea since leaving America last spring, is again in London. His recently published "Principles of Mining" is meeting with keen appreciation.

M. S. Davys, lessee and manager of several mining properties in the Slocan district of British Columbia, arrived in Nelson, B. C., recently from London, England, after an absence of two years.

Robert H. Shield, president of the Arcadia Copper Company, has been in Boston arranging the final details in the taking over of the old company by the recently organized Michigan company.

Joseph Hermon, formerly superintendent of the Rothschild, and recently manager of the Progress mine, Cobalt, Ont., has taken charge of mines owned by the Donaldson Brothers, on Bloom lake.

Lewis Stockett, general manager of the Hosmer Mines, Ltd., Crow's Nest Pass, B. C., will shortly make Bankhead, Alberta, his headquarters, he being also general manager of the Bankhead Mines, Ltd.

James Grant has resigned his position as chief engineer of the Nelson-Jenks Coal Company, at Sand Coulee, Mont., and has accepted a position on the engineering staff of the Amalgamated Copper Company, at Great Falls, Montana.

H. C. Cutler, who has been managing engineer for the Nixon & Wingfield interests for the past four years resigned April 1 on the dissolution of the firm, and has resumed professional practice with offices at Goldfield, Nevada.

E. W. Durfee has resigned his position as general superintendent of the Daly-Judge Mining Company, at Park City, Utah, and has been appointed general manager of the Alvarado Gold Mining Company at Congress Junction, Arizona.

George O. Argall, who has, for several years, been connected with the Iron Silver Mining Company at Leadville, Colo., was, at a meeting of the executive committee held June 3, appointed general manager of the company's properties in place of Waldemar Arens, deceased.

R. G. Drinnan, for years connected with coal mines in the Crow's Nest Pass district, of British Columbia, has resigned as superintendent of the Hosmer colliery to take charge of prospecting work on a large area of coal lands west of Edmonton, Alberta, recently acquired by a Toronto syndicate.

Karl M. Way, formerly with the fuel-testing branch of the United States Geological Survey, has been appointed assistant mining engineer to the Arthur D. Little laboratory of engineering chemistry, in Boston. Perry Barker has been appointed assistant chemical engineer to the same concern.

Allan Gibb, consulting metallurgist to the Tanganyika Concessions, Ltd., left London for Katanga on June 5, accompanied by W. G. Perkins and P. K. Horner, the engineers who will arrange for the immediate erection of the plant for treating 1000 tons of ore daily which has been purchased, and will be shipped to the site selected for the smelting works in Katanga. The plant purchased is intended for treating the ore from the Star of the Congo mine, which will be the first mine reached by the railway that is at present making rapid progress. Mr. Perkins is well known in this country as the builder of the Steptoe Valley reduction works.

Obituary

Zephyrin J. Pequignot, who died in Philadelphia, June 3, aged 63 years, was considered one of the foremost experts in precious stones in this country. He was frequently called in as consulting expert to appraise the value of gems for the Government and for others.

John F. Gibbons died in New York June 5, aged 60 years. He was born in Baltimore and spent much of his life there, removing to New York about 1890. He was prominently connected with the development of the Florida phosphate industry for 35 years, but retired from active business about a year ago on account of failing health. He was vice-president of the Peace River and the Pierce Phosphate companies, and for some years before his retirement was president of the American Agricultural Chemical Company.

Ernest L. Fraleck died at Cobalt, Ont., May 27, aged 33 years. He was born at Belleville, Ont., and graduated from the Kingston School of Mines. He was employed at several Canadian mines as assistant, and later had charge of pyrites mines in Hastings county. When the Cobalt district was opened he went there and took an active part in its development. He was connected with several mines, and for some time past had been superintendent of the Cobalt Lake mine. He was one of the more prominent and promising of the younger Canadian engineers, and his death at an early age is much regretted. He was an active member of the Canadian Mining Institute, and was elected a member of the council at the annual meeting in March last.

Societies and Technical Schools

Colorado School of Mines—At the commencement exercises at Golden, May 29, President Alderson stated that the Walsh research department is to be continued, and that it is not only possible but probable that radium will be produced in Colorado. John Hays Hammond made an address, and an honorary degree was conferred upon him.

Society for the Promotion of Engineering Education—It has been decided to hold the seventeenth annual convention at Columbia University and Pratt Institute, in New York and Brookyln, on June 24, 25 and 26. These dates immediately precede those of the meetings of the American Institute of Electrical Engineers, the Society for Testing Materials and the American Society of Civil Engineers. The program will include the reports of the Joint Committee of Engineering Societies on Engineering Education by Dugald C. Jackson; of the Committee on Technical Books for Libraries by Arthur H. Ford; of the Committee on Engineering Degrees by William F. M. Goss; of the Committee on Entrance Requirements by Robert Fletcher; besides contributed articles. In addition, a special session will be devoted to the discussion of Engineering Mathematics by the committee of fifteen, appointed at the Chicago meeting of the American Association for the Advancement of Science.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Salt Lake City, Goldfield, Colbalt, Mexico

REVIEWS OF IMPORTANT EVENTS

San Francisco

June 4—The interest of mining men still continues to be concentrated on the wonderful quartz discoveries at Alleghany, Sierra county, where each week some new rich strike is recorded. The strange thing is that all these strikes are in old mines, and are the result of active development work, mainly by tunnels. It is only of late that much notice has been taken of this old district. Some of the mines there, now becoming enormously productive were located as early as 1851 and 1852. The surface quartz was removed, and little deep development was undertaken by the owners. Many of these claims were patented nearly half a century ago. In one instance claims located in 1854 and worked but a few months, have recently been sold by the son of the original locator for a high price after all these years of idleness. They were patented so that not even assessment work had been done. In the Rainbow claim the ledge has been struck at a depth of 400 ft. below the old workings and is yielding phenomenally high-grade rock. The El Dorado mine is in the center of the group in which the rich strikes have been made. Mr. Wilson, owner of the Sixteen-to-One, thinks the strike in the El Dorado even more important than that in his own mine. The tunnel is in 500 ft. and the vein found is 2 ft. 6 in. wide.

Of the Morning Glory strike, little is known beyond that very rich ore is being taken out by Rohrig Brothers. In addition to these mines the Plumbago, Oriental, Bonanza King, Wonder and Ophir mines have enriched their owners. The latest strike of note is in the Red Star mine which has struck phenomenally rich ore, some of it being worth $50 per pound. The company has spent $50,000 in prospecting and has run a tunnel 2100 ft. This is a vein parallel to the famous Tightner. Mr. L. P. Woodbury is the manager of the company.

In a number of mines in California since the passage of the eight-hour law for mines and reduction works, the men expressed their willingness to continue on the old nine or 10-hour system with the same wages. It has been explained to them, however, that the operators had no more choice than the men in this matter and that they would be violating the law if they permitted the men to work over eight hours. So when the men had their wages cut to fit the eight-hour schedule, they had only the law itself to make complaint against. In cases where shovellers and others working 10 hours daily for $2 per day were concerned, no reduction was made in wages though they worked two hours less. But where miners were getting $3 for 10 hours and were cut 25c. or more per day to suit the eight-hour system, many of them quit work. Many of the shovellers and other $2 men quit in sympathy, though they got the same pay for two hours less work daily.

At Oroville last week, Judge Sexton granted the motion of the defendant for a non-suit in the action of Churchman vs. Steifer Brothers of the P. B. Steifer Mining Company. Churchman had alleged fraud in the sale of stock and in the management of the mine, saying that money had been misappropriated. The judge could see no testimony offered which warranted the charges. The suit has attracted great attention, there being many stockholders in the company.

Butte

June 2—At the annual stockholders' meeting of the Anaconda Copper Mining Company held at Anaconda last week the following were elected directors: John D. Ryan, F. P. Addicks, H. H. Rogers, Jr., George H. Church, William Rockefeller, U. H. Broughton and Percy J. McIntosh.

The demand of the men for an increase in wages of 50c. per day at the smelter of the American Smelting and Refining Company, at East Helena, was refused by the company last week and the matter of going out on a strike was put up to the men. By a large vote the union decided not to strike and thus averted the trouble which threatened to tie up the works.

H. H. Gerry, Jr., manager of the Missouri River Power Company, and in active management of the negotiations looking to the construction of the Butte & Helena electric railway, states that while arrangements are not fully completed for the construction of the road, work will be begun on it this summer without doubt. The Northern Pacific and the Chicago, Milwaukee & Puget Sound railways are now engaged in a race to secure the most favorable right of way from Missoula westward through the Lolo pass into Idaho. Agents for both companies are on the ground securing consent of the property owners and several condemnation suits have been filed in the district court at Missoula.

The latest development in the affairs of the Idaho Smelting and Refining Company, which formerly operated the Panhandle smelter at Sand Point, Idaho, is an adjudication by the United States district court that the company is bankrupt and the appointment of Bruce Blake as receiver of the company. With the assumption of control by the Federal court all other actions against the company are dismissed, and John Mocine, receiver of the company by appointment of the State court is ousted from the control of the company's affairs. This is a virtual victory for President Anderson, who has, from the first, contended that those behind the previous actions brought against the company were actuated by personal motives.

Annual statements of the East Butte and of the Pittsmont copper companies have recently been filed in the office of the county clerk of Silver Bow county. The East Butte report states that its paid-up capital stock is $2,150,000; assets, $3,171,036 and liabilities nil. The Pittsmont Company's report states that its paid-up capital is $30,000,000; assets, $33,966,595 and liabilities, $3,635,055.

What is probably the most far reaching suit with reference to land grants ever filed by the Federal Government in the State of Montana has recently been instituted against the Northern Pacific Railway Company. The suit involves about 1800 acres of land in the Missoula and Helena land districts. The complaint filed by the Government alleges that the land at the time it was classified by the commissioners was well known to be mineral in character, but that the commissioners, with intent to defraud the Government, falsely classified it and thus enabled the railway company to obtain patent. While the Government has recently won a case involving the same points in an action to recover certain coal lands, yet that case is now on appeal to the Circuit Court of Appeals in San Francisco and the law involved has not been definitely determined. Should the Government succeed in its latest case, numerous others of the same nature will doubtless be instituted.

Denver

June 4—The development of the coal mines of the State is being seriously hindered by the Government indictments against various companies and individuals for alleged fraudulent entries and other charges. In one instance, parties are charged with filing on 1500 acres of coal

land and then transfering it to a company, the Government officials charging that the former had the transfer in mind when they made the filings. The Yampa coalfield of 1200 square miles, which has just been reached by the Denver, Northwestern & Pacific railway, is but slightly affected, as most of these coal lands were taken up before there was any prospect of a railway. That there have been irregularities, is conceded, but no actual fraud has yet been shown, and it is the contention of mining men that the Government should have made its investigations before it took the people's money and granted them patents, and not waited for years until the coal was rendered available by the advent of a railroad.

The Western Petroleum Company has been formed to sink for oil near Trull, in Routt county, a few miles west of Steamboat Springs, the present western terminus of the Moffat road. Oil was struck near Trull eight years ago, but without a railroad it was useless and the well was capped. The prime mover and manager of this new company is ex-Gov. James H. Peabody, of Denver

For some months the Government has been removing the greater portion of the gold stored at San Francisco to Denver for safe keeping, and a shipment of $6,000,000 arrived this week, making a total, it is said, of $375,000,000 stored in the vaults of the Denver mint. The shipments were entrusted to Wells, Fargo & Co., and were made in steel boxes, guarded by heavily armed men night and day until arrival. The new Denver mint is fitted with all the very latest inventions and improvements for safety, and having in view the elements of possible earthquake, burglary and invasion, the Government evidently considers this city a more suitable point than San Francisco for the safe keeping of this enormous store of gold and silver bullion. The Denver mint was moved from the old to the new building in 1904, and coining was commenced in 1906.

The production of the Cripple Creek district for May is given at 57,835 tons of gold ore, of a gross value of $1,360,838, the average value per ton being $23.74. As compared with April this is a decrease of 2300 tons and $21,632 in value. The Iron Clad mill was closed and no figures were given out by Stratton's Independence mill, which ran at part capacity during the month.

The Leadville output for the month of May of all classes of ore reached 67,000 tons, being an increase of 10,000 tons over the corresponding month of last year. This is due to a number of new properties that started shipping during the month, and also to the increased production from the mines in South Evans gulch. It is reported that the Arkansas Valley plant will blow in two more furnaces during the month of June.

Salt Lake City

June 4—The Conkling Mining Company and Nicholas Treweek have filed an amended reply to the amended answer of the Silver King Coalition Company in their suit in the Federal court over ore alleged to have been mined from the Conkling property. The suit involves more than $1,000,000 worth of ore from the famous Elephant stope and the right to mine in that territory. The Wabash company in Park City has made arrangements whereby it will connect its lowest level with the Ontario drain tunnel and work will shortly be resumed in the lower levels of the mine.

Tintic mines during the week ending May 28, produced 189 carloads of ore, as follows: In 50-ton cars, Ajax, 1; Bullion Beck, 3; Centennial-Eureka, 49; Eagle & Blue Bell, 1; Eureka Hill (leasers), 1; Grand Central, 5; Mammoth 12; May Day, 2; Sioux Consolidated, 14; Undine, 1; Victoria, 4; Yankee Consolidated, 2; in 20-ton cars, Beck Tunnel, 3; Brooklyn, 3; Colorado, 30; Dragon Iron, 25; Iron Blosson, 30; North Cliff, 1.

W. A. Kidney, who had charge of the planning of the Ohio Copper mill at Lark, visited the plant last week. He will probably remain until the mill is finished and put in commission, the date of which has been set for the first week in July. Preparations are being made about the property to handle the big tonnage which the mine management expects to produce as soon as the mill is in operation.

A company has been organized by Joseph R. Murdock, of Heber, Utah, to build an oil refinery near Salt Lake City to handle the product of the Pittsburg & Salt Lake Oil Company. The plant will have a capacity to handle about 100,000 gal. per week of the crude product. The plant will consist of refining stills, condensers, agitators, receiving and storing tanks, bleachers and filters. In addition to the refining of illuminating and lubricating oils, the company will manufacture as a by-product candles from paraffin wax.

Formal announcement has now been made of the proposed reorganization of the Newhouse Mines & Smelters as outlined in the JOURNAL of May 22, 1909. Charles A. Moore, of 111 Broadway, New York, together with Frank A. Schirmer and Louis N. Kramer compose the reorganization committee, and security holders who desire to participate in this plan are required to deposit their stock with the Hungarian American Bank, 32 Broadway, New York City, not later than July 1. The cash requirements of the plan are reported to have been fully underwritten.

Goldfield, Nevada

June 1—The town-site controversy, which has been agitated during the last year, involving the ownership of 500 acres of land occupied by the town of Goldfield has finally been settled, and town-site property claimants can now receive title to their ground provided the same has been improved. A payment will have to be made to the district Judge to cover the expenses of the land, which it is estimated will be at the rate of $20 for a lot 30 by 100 feet.

District Judge Peter J. Somers issued a communication to the grand jury last week instructing them to investigate the reports of several mining companies against whom suspicion points as attempting to evade the payment of bullion tax. According to the State bullion tax collector, the Florence Goldfield and the Pittsburg-Silver Peak mining companies are two of the chief offenders.

The Southern Pacific Railway Company filed in the land office at Carson, last week, a map of a projected branch line to extend from Twin Falls, Idaho, to a point on the main line of the Southern Pacific near Cobre, Nevada. The road if built will open up land rich in mineral and timber resources in both Idaho and Nevada.

Articles of incorporation of the Hawthorne & Bodie Railway Company were filed with the Secretary of State last week at Carson. Alonzo Tripp, G. W. Fletcher, J. G. Crumley and others are named as directors. The articles provide for a road operated either by steam or electric power between Hawthorne and Lucky Boy, Nevada, a distance of about 16 miles.

The quarterly meeting of the directors of the Goldfield Consolidated was held in New York May 27 when the regular quarterly dividend of $0.30 per share was declared which amounts to $1,059,711. Geo. Wingfield succeeds Sen. Geo. S. Nixon as president, Mr. Nixon retiring from the board as a result of the recent sale of his holdings in the company. W. C. Roelker succeeds Mr. Nixon as director and Mr. Wingfield's position of vice-president is now occupied by J. D. Hubbard, of Chicago.

The Nevada-California Power Company has completed its line from Millers to Manhattan and that camp is now enjoying the benefits of electric light and power. The line is also being extended to Round Mountain.

Manager Mackenzie's report for the month of April shows a total production of 19,417 tons of ore containing $947,542, the net profit derived from which was $722,175; 385 tons of the above came from the Hampton stope and gave net returns of $287,941. The total cost of production was $6.49 per ton distributed as follows: Stoping, including part of office expense, $2.82 per ton; development, including portion of office expense, $1.10 per ton; transportation, 13.3c. per ton; milling, $2.44 per ton; total, $6.493 per ton. The cost of operating at the new mill was $2.08 per ton. The increase in costs was largely due to the heavy ground encountered in the Clermont shaft where the stations and skip pockets were cut. A safety device to pre-

vent overwinding has recently been installed at the Clermont and Mohawk shafts.

Production of the Tonopah district for the week ending May 29 was: Tonopah Mining, 3400 tons; Montana Tonopah, 955 tons; Belmont, 850 tons; MacNamara, 250 tons; West End, 125 tons, and Midway, 100 tons; total estimated value, $140,000.

Cobalt

June 5—It is expected that the sale by the Provincial Government, of 800 acres of the Gillies Limit will not arouse as much interest, or bring in as much money, as it would have done two years ago. This section of the Limit surrounds the Provincial mine, and has been prospected by the Government for about three years with few encouraging results. The lack of interest is due largely to the poor showing of the Provincial mine, on which about $100,000 has been expended, while the return from the sale of ore is little more than a tenth of that amount.

Recent developments in the Keewatin formation have exploded many of the theories formerly held regarding its productiveness and depth. In the great majority of cases when the veins reach the Keewatin the values give out, and so convinced were the mining men of its unproductiveness that but little development work was done in this series. Some time ago the lower workings of the Crown Reserve entered the Keewatin, and the ore was found to be fully as good as in the overlying diabase. Last week one of the Nipissing workings went through the Keewatin into the diabase. As the mineral contents of the veins are generally conceded to have come up with the diabase this latter discovery is likely to have an important bearing on the future development of the camp.

On May 28 a new high-grade oreshoot was encountered in No. 5 vein of the King Edward mine, while drifting west on the 80-ft. level. The vein is about 4 in. in width and consists of calcite carrying native silver, while for about 1 ft. on each side, the wallrock is also well mineralized. This is the third discovery that has been made in this mine within a short period.

The Station Grounds Mining Company, which has been purchasing power for two drills, from the Cobalt lake, has decided to stop operation until the Hydraulic Power Company's air is ready for distribution. Prospecting will be carried on in the meantime with the aid of a diamond drill.

Following the discovery of ore in the Beaver mine, the plant, which was destroyed by fire some time ago, will be rebuilt.

For the past nine months the Coniagas Mining Company has been carrying on experiments in the smelter at Thorold, to improve the process for the reduction of Cobalt ores. The plant is now doing such satisfactory work that the company will enter the market for custom ores, in competition with the other smelters. The capacity will be about ten tons of high-grade ore or concentrates a day.

On May 24 another new vein was discovered on the Farah property, making the second discovery within two weeks. The shaft which is being sunk about the middle of the claim is now down 100 ft. When a depth of 125 ft. is reached a station will be cut, and crosscuts run to tap the veins.

The development of the Lawson property by La Rose, is being watched with great interest on account of the remarkable surface showing of the vein. Work is being carried on from an old shaft, sunk by the Silver Leaf, and which, through a mistake in the survey, is located on the Lawson claim. A drift is being run from the bottom of the shaft, and the management expects to encounter the main orebody shortly. The new vein discovered a short time ago, will also be developed from this working.

The framework for the new concentrator at the Colonial mine is being erected and the stamps are already in place. A 5x16-ft. tube mill, to be driven direct from a motor, has been ordered. The power to run the mill will be obtained from the Electric Power Company when its plant is installed, and it is expected that the mill will be ready by that time.

The rush up the Montreal river from Latchford is so great that the Upper Ontario Navigation Company is unable to accommodate all the people. In one week over 800 men made the trip on the company's boats. The transportation of heavy freight is out of the question for the present, owing to the high water, and there are now about 30 cars of freight, on the siding at Latchford, waiting to be unloaded.

Mexico

June 5—Numerous railroad projects in southern Mexico promise to greatly influence the future development of the mining industry of that portion of the Republic. A much needed and important line is projected from San Juan, near Toluca, to the Temescaltepec, Sultepec and Zacaulpan districts of the southern part of the State of Mexico. This line would probably be extended to furnish an outlet for the famous Taxco district, now six hours by trail from the Cuernavaca division of the Mexican Central. This road has been concessioned by the Federal and State authorities but the money has not been raised to construct it. The parties to whom the proposition was made contend that the road should be extended to the coast in order to insure profitable operation. This road is very much needed, and the government is desirous of having it built.

Another projected line runs from Puebla south to the Nochestlan coal district, then to an iron-bearing area, continuing to the Pacific at Port Angel. This is backed by European capital interested in the exploration of the coal and iron deposits of Oaxaca. It is assumed that construction on the first section will be commenced this year. The road will serve as an outlet for the extensive antimony deposits near Tlaxiaco, Oaxaca, controlled largely by the Cookson syndicate. There is also a new lead-silver district in northern Oaxaca, near Huajuapam, that would be benefited by the road. The Mexican Southern railway, an English company, has recently purchased the uncompleted line to the Taviche camp and the Oaxaca and Tlacolula line. The first is being rapidly completed to Taviche. The other line will be extended to Tula to serve the Magdalena district and ultimately connect with the Tehuantepec Isthmus line, affording an easy outlet to the Gulf or the Pacific for all of southern Oaxaca. This extension passes near the Tatolopam mining district, one of the richest in the Republic. Another concern held by St. Louis, Mo., parties covers a practical line from Oaxaca to the Pacific coast via the Rio Verde, tapping the Minas Santiago district where there are large deposits of copper and iron. This was originally projected by C. A. Hamilton and associates as an electric line, the power to be furnished from the numerous and ample falls in the Rio Verde.

A Salt Lake City syndicate has a concession for a line from Oaxaca to the coast, and along the coast to Acapulco and Manzanillo. This is in strong hands but its immediate realization can hardly be considered now. It would open up a rich agricultural and mining country. The Tehauntepec road, planned primarily for transcontinential business, is a factor in the opening up of several camps in southern Oaxaca, and has stimulated activity in prospecting in the Isthmus region. Likewise the Pan-American line, along the Pacific coast from the Tehauntepec road to Guatamala has made available several low-grade lead and copper properties, in the vicinity of Tonala and in Chiapas. The navigation of the Rio Balsas, now being undertaken as an experiment, promises to open up a very rich and extremely isolated mining region. All these projects are of vital importance to the mining of southern Mexico, and the realization of some of them will greatly improve the conditions in this rich mineral zone.

The mining law has passed the Chamber of Deputies in a form very favorable to the mining interests, and it is now before the Senate where it is expected that favorable action will be taken on the essential points of the measure. It is to become effective January 1, 1910.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

General Mining News

Amalgamated Copper Company—At the annual meeting, June 7, J. H. Harding and James Jourdan were elected directors to succeed the late A. R. Flower and the late H. H. Rogers. The other directors were reëlected. A statement for the fiscal year was submitted which will be found on another page.

United States Smelting—All of the company's plants, with the exception of the Utah copper smelter, are operating at their full capacity. In California, the Mammoth smelter is now treating 1200 tons of ore per day, producing 3,500,000 lb. of copper per month, which is the highest rate of production ever obtained at the Mammoth smelter is now treating 1200 plant is treating 670 tons daily.

American Smelting and Refining Company—The earnings of the company are said to be at the rate of 8 per cent. per annum on the $50,000,000 common stock. This is largely the result of the recent recovery in the prices of copper, silver and lead. While the advance in price is small, it has been sufficient to cause an increase in metal production in Mexico, and as a result the plants at Chihuahua, Torreon, Monterrey and Aguascalientes are now operating on an 80 per cent. basis, whereas 60 days ago they were operating only 60 per cent. capacity. El Paso smelter is now operating at 80 per cent. of its capacity, which is the highest of any plant of the company in the United States.

Alaska

JUNEAU

Alaska Treadwell—April: 240-stamp mill 30¾ days crushed 37,100 tons of ore; estimated value of bullion, $58,662. Saved 465 tons of sulphurets; estimated value, $38,647. Working expenses, $81,133.

Alaska Mexican—April: 120-stamp mill 30½ days, crushed 18,385 tons; estimated value of bullion, $44,952. Saved 414 tons of sulphurets; estimated value, $34,309. Working expenses, $30,057.

Alaska United—April: Ready Bullion claim, 120-stamp mill 30 days; 700-ft. claim, 100-stamp mill 30½ days; crushed 36,297 tons; estimated value of bullion, $49,672. Saved 575 tons of sulphurets, estimated value, $33,220. Working expenses, $60,235.

KUSKOKWIN

The gasolene schooner, "P. J. Alber," of Seattle, is expected here with miner's supplies for 47 different points, indicating renewed activity for this important section.

NOME

T. H. Thatcher, manager of the Alaska Banking and Safe Deposit Company of Nome, predicts a greater output for this season than in 1908. Extensive dredging operations at Nome, Kougarok and other points in that vicinity give great promise.

VALDEZ

It is reported that the Guggenheims have acquired a lease on a quartz claim in the Hope mining district, near Cook's Inlet. The property is on the peninsula near the mouth of Palmer creek. Vaulable ore deposits are said to exist.

Arizona

PINAL COUNTY

Ray Consolidated—The report issued by the executive committee shows that 21,077,241 tons of ore have been developed on 60 acres, the copper content of which is 46 lb. per ton. About 500 acres display the same character of rock and surface indications as the areas already developed. Transportation facilities are all that could be desired. An excellent site for a mill has been provided near the Gila river.

California

AMADOR COUNTY

Ione Copper—Superintendent Tarrtau recently installed new machinery, put up new buildings and started mining work. Some of the ore carries gold and silver as well as copper.

Bunker Hill—After paying its usual monthly dividend this company has about $65,000 in its treasury. The main shaft will be straightened and repaired.

Garibaldi Placer—This hydraulic mine at Volcano will hereafter be worked by drifting. The clean-up for this season was nearly $20,000.

BUTTE COUNTY

Shakspeare—This group at Forbestown, has been acquired by M. J. Cooney and B. F. Forbes, of Oroville, and Mrs. H. E. Vail.

Magdalia—Matt Bader has sold to A. E. Smith, for $20,000 on deferred payments, the mineral on 160 acres of land near Magdalia. Many claims are being opened on the Magdalia ridge.

CALAVERAS COUNTY

Calaveras Engineering Company—This company has been organized at San Andreas by S. R. Fox, T. W. Downer, F. E. Tiscornia and others, and will work the Eastland-Gray mining properties on the Calaveras river, near Donellan's bridge. Arrangements are being made to install a dredge.

INYO COUNTY

Ruby Silver—J. H. Oliver, of Goldfield, Nev., has made a discovery of ruby-silver ore near Cottonwood Springs, in Death Valley. A number of prospectors have gone to the camp.

Casa Diablo—Forty men are now employed. Much new machinery has recently been installed and the mine has become productive. Clarence Beale is superintendent. The mine is 20 miles north of Bishop.

Greenwater Copper—The shaft is down 1400 ft. and will be continued to the 1500-ft. level in hopes of finding a paying grade of ore.

SHASTA COUNTY

Washington Gold—This company has incorporated at Redding to work the old Washington mine, at French gulch. The incorporators are C. C. Fox, C. L. Watson, Charles Gilzean, Joseph Porter, and F. Stabel.

Consolidated Gold Dredging Company—The dredge belonging to this company is being moved up the Sacramento river from Clear creek to Middle creek, where it is supposed better ground exists.

Friday-Lowden Copper Company—This company has been incorporated to operate the Friday Lowden group of claims between the Mammoth and Trinity copper mines. T. H. Benton and John R. Lowdon, of Redding, are the principal owners, Mr. Benton being the president of the new company which controls 15 acres of mineral ground.

SIERRA COUNTY

West Point—This mine near Downieville has been bonded by Peckwith & Spalding to a San Francisco company represented by F. M. Phelps. It adjoins the White Bear.

Kate Hardy—Tyler Dudley, who has recently begun working this property at Forest, has broken into the old works, closed 40 years ago, and found excellent ore.

Minnie D.—L. A. Wagner has bonded this mine and the Gold Cañon at Alleghany and set crews of men at work.

Alleghany—Numerous rich strikes continue to be recorded at this place in addition to those of the Sixteen-to-One, El Dorado, Tightner and Rainbow mines.

Large numbers of men have gone to that section, which is, however, not a good place for poor men, as most of the discoveries have been made in tunnels which have taken some years to cut.

TUOLUMNE COUNTY

Big Casino—Lee & French, who have a lease on the Two Brothers and Little Sister claims of this company, have put in a hoist and other machinery and the mill is being put in order to crush the ore. The mine is near Groveland.

Colorado

LAKE COUNTY—LEADVILLE

Lillian—The lessees working in both the upper and lower levels of this Iowa gulch property are doing well, and are shipping a fair tonnage of ore running well in gold.

Houston—A tunnel is being driven by lessees on this claim to catch the main orebody. Several pockets of rich gold ore have already been taken out.

Long & Derry—A tunnel is being driven from the foot of the hill to open the oreshoot worked from the surface in the early days. About 150 ft. is yet to be driven before it is beneath the orebody.

Carbonate Gypsy—The shaft on this claim is now down 450 ft. and is to be sunk 50 ft. farther. The shaft passed through 200 ft. of porphyry and is now in the limestone.

Mikado—A lease has been taken on this Graham park property by local men. The shaft is being retimbered and the machinery overhauled.

Tribune—The vein recently encountered in this Breece hill property has been opened for a distance of 85 ft. and is reported to be of higher grade than when the strike was first made. Preparations are being made for a 50-ton shipment.

Yak Tunnel—A lateral from the tunnel has been started to connect it with the Resurrection No. 1 mine, which has been drained. It is stated that when the connection is made with the Resurrection property the company will probably lease the ground in blocks.

Horseshoe District—Snow is still so deep in this section that active mining cannot be resumed for several weeks. The Hilltop, Last Chance and Belvidere tunnel is working a small force of men, which will be increased as soon as the roads are open.

SAN MIGUEL COUNTY

Tomboy—Reports from London show an estimated production of $62,900 in gold, with $36,500 working expenses, leaving an estimated profit for the month of $26,400.

TELLER COUNTY

Kimball—A concentrating plant for the treatment of the tailings on the site of the old El Paso reduction works near Gillette, is being installed by George K. Kimball, of Idaho Springs, who has secured a lease and will clean up the dumps. The tailings accumulated in the early days of the district when the saving effected by the chlorination process was much lower than by the cyanide process now in use. The dumps have been carefully sampled and the average value per ton is said to approximate $2.50.

Idaho

IDAHO COUNTY—GRANGEVILLE

Owing ot the cold weather in the mountains the snow is melting very slowly. The water supply is low, necessitating the placers closing down.

IDAHO COUNTY—ROOSEVELT

A heavy landslide is reported from this region. The slide started at the Caswell & Curran placer on Thunder mountain and dammed Mule creek.

SHOSHONE COUNTY

Snowstorm—This mine is reported to be increasing its shipments. On June 1 twenty 40-ton cars were ordered to be loaded.

Standard—Reports indicate that a rich orebody has been encontered in the shaft at the 1650-ft. level; the ore is said to be even better than that on the 1450 level.

Gold Cliff—Good ore is reported to have been found on this property east of the Mother Lode company's holdings. The owners of the company are A. B. Rhude, of Murray, and Dr. W. B. Richardson, of Spokane.

Indiana

GREENE COUNTY

Shirley Hill No. 1—This mine has been reopened, and operation commenced after being closed for nearly two years. The mine works nearly 200 men.

SULLIVAN COUNTY

Hymera No. 33—This mine, of the Indiana Consolidated Coal Company, is boasting of having made the best record of any mine in this field since March 1, having been idle only two days in that time, and one of these days was a holiday. Other mines in this county are not experiencing the lull that usually comes the first two weeks in May, and the season so far is the best ever known for this time of the year.

Bellevue Coal Company—This Delaware corporation has been admitted to do business in Indiana under the foreign corporation act. This company proposes to mine and ship coal from this county. The resident office will be in Carlisle with William H. Arnold in charge.

Michigan

COPPER

Keweenaw—A series of drill holes is being put down throughout the tract and in this manner the Kearsarge and Osceola lodes are to be exposed. Operations at the Medora shaft continue on a limited scale to further open the west fissure vein at depth on what is known as the north lode.

Isle Royale—The A shaft, on the Baltic lode, has reached a depth of 425 ft. Copper has been revealed from time to time in the shaft. The shaft is nearing the depth that the lode was cut by the drill core and will probably enter the formation within a very short time.

Quincy—At a depth of about 400 ft. in the No. 9 shaft the formation has deflected and the shaft is going down in the footwall. The copper-bearing portion of the lode passed out of the shaft at a depth of about 210 ft. Drifting in the direction of this shaft from No. 8 shaft is opening good grade of ground.

Franklin—Drifting continues at the 23d, 24th and 25th level of this company's No. 1 shaft on the Pewabic lode with a good grade of copper rock opened throughout. The north drifts are approaching the Rhode Island tract, and indications are that this land carries the underlay and it will be but necessary to sink deeper.

Cliff—Work has been suspended on the Cliff property which is controlled by the Tamarack. The diamond drill near the Ojibway line is under way to expost the Kearsarge lode and this work will be continued.

Montana

BROADWATER COUNTY

Ohio-Keating Gold Mining Company—A gasolene plant has been installed at the property, near Radersburg, with a view to saving on fuel cost until arrangements can be made to use electric power. Water rights have been secured, which will later be utilized for the generation of electricity. John H. Cowan, of Salt Lake City, is general manager of the company and Charles S. Shoemaker, formerly State mine inspector of Montana, is in charge of operations at the mine.

CARBON COUNTY

Butcher Creek Oil Fields—Thomas Cruse, of Helena, has recently acquired all outstanding interests in the district, and is now making preparations for a thorough exploration of the fields. Machinery for drilling has been on the property for some time, but until now conflicting interests have made it impossible to work the property.

CASCADE COUNTY

Great Falls Gas Company—The company has recently purchased from the Northern Montana Coal Company and E. R. Clingan, 2040 acres of coal land, near Belt. It is the purpose of the company to use the lands for obtaining coal to be used in the company's new gas plant now being constructed at Great Falls.

Nevada

CHURCHILL COUNTY—BOYER

It is reported that capitalists from Wilmington, Del., have made a first payment on the Boyer copper property comprising 27 claims located at this point, the sale price being announced as $250,000. The deposit consists of a porphyry intrusion, mineralized from 30 to 1000 ft. in width. The company will be known as the Boyer Nevada Copper Company; the provisional directors are: Dr. F. R. Carpenter, of Denver, president; H. R. Durkee, of Chicago, vice-president, and Arthur H. Carpenter, of Denver, secretary and treasurer.

ESMERALDA COUNTY—GOLDFIELD

Jumbo Wonder—This lease on the Poleverde claim of the Jumbo Extension Company was forfeited some time ago and has been secured by a group of Philadelphia men, among whom are W. D. Hickman and W. F. Rose. A contract has been let for sinking the shaft 200 ft. from its present depth of 250 feet.

ESMERALDA COUNTY—HAWTHORNE

Spencer Lease—A strike of exceedingly rich ore is reported as having been made in this property at a depth of 300 feet.

Elgin, Randall and Cardew Lease—J. C. MacCormack, of Goldfield, purchased this lease on the Lucky Boy No. 1 lode last week. The former leasers worked about 60 days and sank their shaft to a depth of 90 ft. through pay ore a greater part of the distance. In the bottom of the shaft there is now exposed 2½ ft. of ore which runs in excess of $100 per ton.

ESMERALDA COUNTY—MINA

Lucky Man Mine—A strike was made last week on this property situated two miles north of Mina. The vein, 18 in. wide, was encountered in a crosscut from the main tunnel and assay returns run high in gold, silver and lead.

ESMERALDA COUNTY—RAWHIDE

King-Heisner—A large portion of the frame work for the new mill is in place. The telephone line from the water-works to the mill and town is completed.

Grutt Mining—Work has been started at the 100 and 200-ft. levels of the Wild West claim. It is 90 ft. to the shoot of high-grade ore which is being developed so extensively in the Marigold property.

Queen Bethania—A 4-ft. vein of gold-bearing quartz has been encountered. A shaft is to be started and development work carried on extensively.

Steinheimer—Fifty tons of ore from the McMann claim was shipped recently to the Selby smelter. The ore is said to contain approximately $85 gold per ton.

LANDER COUNTY—AUSTIN

Patriot—This property located north of Austin has been acquired by the Maricopa Mines Company, of Arizona. The company is a close corporation, and is composed of men from Cleveland Ohio, principal owners being L. F. McGrath, A. J. Rogers, J. F. McGraw and E. A. Richardson. The shaft will be repaired, a new hoisting and compressor plant installed, and operations pursued on a large scale.

NYE COUNTY—BELLEHELEN

Sciota Nevada—It is reported that a steam hoist and ten-stamp mill have been ordered by this company. The property is opened by a 200-ft. shaft, from which laterals have been run, also by a tunnel 600 ft. in length.

NYE COUNTY—BULLFROG

Tramp Consolidated—A fair sized body of ore has been blocked out on the Clothier & Jingles lease. Four hundred sacks of ore averaging $100 per ton are now ready for shipment. On the Kuliacka-Vucovitch lease work is being pursued on the lode at two different points; the vein varies from 10 to 15 in. in width, the ore ranging from $60 to $175 per ton in value. A shipment is now being prepared, to be sent out in June.

Montgomery Shoshone—This property is now producing an average of 200 tons daily. A shipment of bullion was made last week, having a valuation of approximately $18,000 which was the result of the semi-monthly cleanup.

NYE COUNTY—MANHATTAN

Placers—About 150 men are now operating on various placer deposits in the gulch between Manhattan and the Smoky valley. The daily cleanup is estimated at $1000. Nuggets worth from $5 to $15 have been found, the largest recorded being worth $22.50. The average yield of the gravel is in the neighborhood of $10 per yd. The Pneumatic Dredger Company, of Sacramento, Cal., has a machine *en route* to Manhattan which is expected to handle 500 yd. per day.

NYE COUNTY—PIONEER

Puritan Savage—A strike was reported last week on this property, which is situated about a mile northeast of town. The shaft, which is 85 ft. deep, has encountered a vein of good ore from 4 to 6 ft. in width.

Bullfrog Pioneer Lease—Ore of a high grade has been encountered in the bottom of the winze from the 210-ft. level. Electric power was turned on last week. The production for the week was in excess of $30,000. About 60 men are now employed at the mine.

Rickard-Garburg—Ore was disclosed in the tunnel level of this lease last week which assays up to $40 per ton. Three shifts are now employed and the ore is being sacked for a trial shipment.

NYE COUNTY—ROUND MOUNTAIN

Round Mountain Mining—The production of this company for the first 15 days of May, amounted to nearly $17,000. Electric power will be furnished the property this month.

NYE COUNTY—TONOPAH

Tonopah Mining—The Mizpah shaft is now down to a depth of 1386 ft. A crosscut is being run at the 1380-ft. level and a sump will be cut about 20 ft. from the shaft, and the water from above will be collected at this level. The compressor has been found inadequate for the demands made upon it, and another has been ordered. The 150-h.p. hoist at the Mizpah shaft has been replaced by a 300-h.p. electric hoist which handles the load easily. The mill report for week ending May 22, shows 3225 tons of ore crushed; average value of $20 per ton; 64 bars of bullion, valued at $850 per bar, and 27 tons of concentrates at $425 per ton were shipped.

WHITE PINE COUNTY

Cumberland-Ely—According to a circular issued by a New York brokerage house, the investment of this company in the Steptoe reduction works is $3,000,000, on which it has a guarantee of 8 per cent. In addition, Cumberland-Ely is said to be receiving $300,000 per annum as its half share of the net earnings of the Nevada Northern Railroad. The circular concludes as follows: "More than half of the 1,300,000 shares of Cumberland-Ely are owned by the Guggenheims and their associates. The rest of the stock is very widely distributed, the books of the company registering 1600 share holders. We believe that in the near future Nevada Consolidated and Cumberland-Ely will be joined in one great company. This coalition will insure Cumberland-Ely share holders *an attractive proportion of the profits of its steam shovel neighbor.*" The italics are our own. The stockholders of the Nevada Consolidated are yet to be heard from.

New Mexico

GRANT COUNTY

Chino Copper Company—This is a new company organized by Hayden, Stone & Co. to operate the Santa Rita mine. Of the authorized issue of 700,000 shares, 375,000 shares are being delivered in exchange for an equal par value of the entire capital stock of the Santa Rita Mining Company. Of the balance of 325,000 shares, a portion is now being sold for cash at $5 (par value) per share, and the balance is under option at the same price. Active operations at the property in the development of the porphyry deposits have already been begun under the direction of A. Chester Beatty, who is engineer for the new company. John M. Sully has been put in charge of the property. D. C. Jackling will be chairman of the board of directors.

SOCORRO COUNTY

Socorro Mines—The company has secured control of the Little Fannie, Champion and Consolidated groups at Mogollon. The mill at present is treating 60

tons per day with an extraction of 89 per cent. A new 150-ton mill is being built, also a 600-kw. hydroelectric plant.

Pennsylvania

Anthracite Coal

Philadelphia & Reading Coal and Iron Company—The statement for April and the 10 months of the fiscal year from July 1 to April 30 is as follows:

	April.	Ten Mos.
Earnings	$4,633,804	$30,292,772
Expenses	4,375,821	28,609,975
Net earnings	$ 257,983	$1,682,797

For the 10 months there were decreases of $2,568,799 in earnings; of $1,990,903 in expenses, and of $577,896 in net earnings.

Delaware, Lackawanna & Western—The old wooden breaker at the Taylor colliery, near Scranton, is to be replaced by a reinforced concrete structure. In this the company is following its recent policy of using concrete wherever possible. Wooden breakers are comparatively short-lived; but the most serious objection to them is their liability to take fire, involving not only the destruction of the building, but the loss of valuable machinery. The plans for the breaker have been drawn by Bradford Sampson, Lackawanna superintendent of construction.

Bituminous Coal

Monongahela River Consolidated—The financial statement for the half-year ended April 30 gives the net earnings at $978,511, a decrease of $373,078 from last year. Charges were: Royalty, $199,542; depreciation, $212,098; taxes, insurance and interest, $447,575; total, $859,215. This left a surplus of $119,296, which is a decrease of $291,193 from last year.

South Dakota

Lawrence County

A severe flood has caused a suspension of most of the mines in the Bald Mountain district. Few of the mines were flooded, as electric power was available and in almost every case the pumps were kept going. Railroad connection with the mills, most of which are at a distance from the mines, has been broken. All those treating Bald Mountain ore have temporarily suspended.

Utah

Beaver County

Cedar-Talisman—A large cave has been opened and on its floor is a layer of 3 or 4 ft. of lead carbonate ore with evidence of higher silver content than in the other ores of the mine. S. S. Pond, manager, Beaver, Utah.

Juab County

Chief Consolidated—This company has purchased the Granite claim and one-half interest in the American Star and Blackbird claims. This new ground, together with the Little Chief holdings, gives the company a desirable territory in the Tintic district.

Montana—Orders have been placed for buildings and equipment for this property. The purchase includes a 125-h.p. compressor, an 8x10 air hoisting engine capable of operating to a depth of 750 ft., power drills, and ventilating and lighting systems.

Iron Blossom—The management is opening an orebody in a drift from the south shaft that promises to become an important source of revenue. President Jesse Knight said: "We are drifting on a full face of ore which contains no lead, but of uniform content of silver and gold which makes it of shipping grade. We have followed a streak of copper ore to considerable depth in this shaft, and this leads me to believe that with depth we will find plenty of copper ore in this part of the property."

Tintic Standard—The big fissure which has just been crosscut on the 400-ft. level is proven to be 87 ft. wide. The grading for the headframe for the new shaft has been completed. The hoist is to have a capacity for sinking 1000 ft. E. J. Raddatz, general manager, Eureka, Utah.

Utah County

Mountain Dell—A streak of high-grade silver ore, described as "almost native," has been found in the raise which is being driven to connect the 800-ft. tunnel with the inclined shaft in American Fork cañon. The tunnel will completed in 30 days and it is then expected to develop the high-grade streak. Considerable ore of shipping grade has been developed in the shaft. R. N. Baskin, general manager, University Club, Salt Lake City.

Burgess Consolidated—This property, immediately south of Miller hill, in American Fork cañon, will resume work.

Virginia

Buckingham County

Ferncliff Slate Company—This company, with office at Rochester, N. Y., proposes to develop slate properties at Arvonia; also proposes manufacturing structural and roofing slate, slate acid vats, slate insulators for electrical wires, etc. E. E. Crook is general manager.

Washington

Jefferson County

Construction on James A. Moore's steel plant at Irondale continues steadily.

King County

Grand Ridge—C. J. Smith, A. S. Kerry and Andy Reynolds, of Seattle, have purchased the Grand Ridge coal properties at Issaquah under the name of the Central Coal Company, and will mine coal within 90 days from a portion of the 400 acres acquired.

West Virginia

Monongalia County

Francis Rock and associates, of Uniontown, Penn., have purchased 3000 acres of coal lands in Monongalia and Marion counties. It is proposed to construct 1000 ovens, to have a daily production of 2500 tons of coke. L. A. Phillips, of Grays Landing, Penn., is the engineer in charge of construction.

Philippine Islands

Benguet

Benguet Consolidated Mining Company—The output for the month of March was 235 oz. gold.

Camarines

San Mauricio—The equipment has arrived and is now being installed. It is the largest shipment of mining machinery ever brought to the Philippines. It includes a complete mill of 20 stamps, concentrators, an electric-light plant complete and power machinery. President Heise states that the installation will be complete and the plant operating by the end of 1909.

Paracale

Paracale Gold Dredging Company—This company reports 644 oz. gold saved in March from its dredging work in the Paracale river.

Canada

British Columbia—Queen Charlotte Islands

Awaya Ikeda & Co.—Ore shipments in May to the Tyee smelter at Ladysmith totaled about 1000 tons, making nearly 9500 tons since shipments were commenced. Output for April was 884 tons, averaging 7 per cent. copper and about $3.50 per ton in gold and silver. Total footage in four tunnels driven is 1500 ft. Lowest tunnel is in 800 ft. in ore practically all the way. Recently a 6-ft. dike was encountered and after going through this the tunnel entered an orebody proved to be 26 ft. wide with a footwall not yet reached. The manager, A. Ikeda, of Vancouver, B. C., is arranging to install additional power equipment. Recent developments at this mine are regarded as the most important that have taken place since the commencement of mining operations on the islands about two years ago.

British Columbia—Vancouver Island

Tyee Copper Company—Of several properties the company is developing, results from one or two indicate early profitable production on a considerable scale. The smelter at Ladysmith had a full month's run in April with one furnace, smelting about 7000 tons of ore. Much work is being done at mines from which the smelter derives its ore supply, so that directly market values improve there will be ample ore to keep two furnaces going. The second furnace is being installed. W. H. Trewartha-James, of Victoria, B. C., general manager, W. J. Watson, smelter manager, and J. W. Bryant, mining en-

gineer, have returned from their recent trip to Queen Charlotte islands.

NOVA SCOTIA

Dominion Coal Company—The coal output for May was 306,888 tons, as against 335,829 tons for May, 1908. The total for the five months ended May 31 was 1,263,458 tons, as against 1,578,923 tons for the corresponding period last year.

Nova Scotia Steel and Coal Company—R. E. Chambers, the company's iron-ore expert, has gone to Newfoundland to arrange for a larger output this season from the ore deposits at Wabana. Contracts for 310,000 tons for shipment abroad have already been made, of which about 100,000 tons will go to Germany, 150,000 to the United States and 60,000 tons to Great Britain Thomas Cantley, general manager, estimates the coal output of the season at 800,000 tons, the company having a present coal-producing capacity of about 1,000,000 tons yearly.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended May 29, were as follows: Buffalo, 43,574 lb.; Crown Reserve, 161,680; Chambers-Ferland, 60,000; La Rose, 195,680; McKinley-Darragh, 46,780; Nipissing, 194,146; Nancy Helen, 43,400; O'Brien, 128,190; Right-of-Way, 81,228; Temiskaming, 59,000; Trethewey, 65,300; total, 1,078,978 pounds.

Beaver—A new powerhouse, 35x50 ft., is being erected. A headframe will be built over the main shafthouse. New machinery is on the ground for installation when the buildings are completed. The first shipment will shortly be made, 235 bags of high-grade ore being already sacked.

Crown Reserve—Six drills are working on development operations and two on stoping. From the drift under the lake at the 100-ft. level a crosscut has been finished for 530 ft., and from No. 1 vein a crosscut has been run 87 ft., and has penertated a diabase formation.

Hargrave—The main shaft on the Jacobs vein is down 270 ft., and will be sunk 30 ft. further, when a crosscut will be made to intersect the vein at the 300-ft. level and a drift run to the Kerr lake line.

King Edward—A discovery has been made in drifting at the 80-ft. level of No. 5 vein where a vein was struck 11 in. wide, running over 3000 oz. silver to the ton. The wallrock also carries silver.

Little Nipissing—A 12-in. vein of calcite running about 3000 oz. to the ton in native silver was struck on June 1 on the Peterson lake leasehold of the Little Nipissing, on a raise between the 160- and 100-ft. levels.

Silver Leaf—The diabase formation will be explored in the expectation of finding Huronian underneath it. A shaft on the north end of the property is down 40 ft., and will be put down to 300 ft. with the object of reading the Huronian. Forty men are at work trenching.

Cobalt Gem—A massive nugget 5 ft. 6 in. in length, 2 ft. 5 in. wide, and 16 in. thick, 75 per cent. pure silver and valued at $16,000, has been found near the surface at the foot of a cliff 60 ft. high on this property. It will be forwarded to Philadelphia, the company being controlled by people in that city.

La Rose—This company has obtained permission from the Right-of-way to run a crosscut under the railway so that it can work its holdings on the town side of the track, which will be developed from the first level of the La Rose. The work on the crosscut has been begun.

ONTARIO—MONTREAL RIVER DISTRICT

Otisse-Currie—Another shaft is being put down on the northeast corner of the property. At the depth of 6 ft. the vein shows about 7 in. of decomposed calcite, cobalt, galena and silver. At No. 1 shaft 71 ft. of sinking, 161 ft. of crosscutting and 133 ft. of drifting have been accomplished, and the vein continues to hold its value.

Mexico

CHIHUAHUA

Calabacillas—A 50-ton cyanide plant is being erected at this mine, not far from the Sinaloa and Durango State line. The plant is for handling the accumulated tailings, as well as a large tonnage of low-grade ore. The property is owned and operated by W. H. Brevoort, of New York and Paris. The mine is reached from Fuerte, Sinaloa.

Lluvio de Oro—Burt filters are being installed at the cyanide plant. The small plant has proven so successful that plans are being made for the early erection of a larger one. A small amount of bullion is being produced from working over the old tailings.

Tepochique Gold and Silver Mining Company—The mine is situated in the vicinity of Barranca de Cobre and is preparing for the early resumption of work under the direction of Dr. C. F. V. Caracristi.

Moris Camp—A number of mining properties in this district have recently been purchased by Canadian capitalists, among whom is the owner of the O'Brien mine at Cobalt.

Santa Elena and Bert—J. D. McKenzie and J. D. Harbottle, of Chihuahua, have acquired these properties, owned by R. Anderson in the Terrazas district. Development work is under way and a good showing of ore has been found in a 120-ft. shaft.

Durazno Mines Company—H. B. Pope and other Pittsburg people have recently made another payment of 25,000 pesos on this property in western Chihuahua. It is reported that the reduction works, consisting of amalgamation and cyanidation plants will be placed in commission shortly.

International Gold Mines Company—A Kansas City concern, managed by J. W. Pender, will discontinue cyanidation and return to concentration of its ores. The property is west of Ocampo in El Socorro district.

American Smelting and Refining Company—Two additional furnaces are being added to the Chihuahua plant, making five in all. This will give the smelter a capacity of 750 tons per day.

MEXICO

Esperanza—Report for April: The mill operated 27 days, crushing 14,451 tons of ore. Estimated value of bullion produced, $127,785; estimated value of concentrates, $49,848; receipts from rents and other sources, $748; total, $178,381. Less all working expenses and treatment charges on concentrates shipped to smelters, $112,258. Net proceeds, $66,123.

Mexico Mines of El Oro—Report for April: The 40-stamp mill ran 24 days, crushing 7240 tons of ore. Estimated value, $110,120; working expenses, $38,750; development expenses, $6800; net proceeds, $64,570. In addition to this 23 tons of high-grade ore were shipped to smelters, yielding net proceeds of $6750. Total profit for the month, $71,320.

SONORA

El Tigre—The adjourned annual meeting of the stockholders was held recently at Douglas, Ariz. The capital stock was increased from $650,000 to $8,000,000. Seven directors only were elected to take the place of 13 which have heretofore served. The new directors are T. C. Fooy, C. S. Jobes, John B. Seitz, W. A. Moses, John Kelley, E. J. Street, and C. M. Evans, all of Kansas City. Of the $8,000,000 of new stock voted, $1,000,000 is placed in the treasury for further improvement at the mines. Six million, three hundred and fifty thousand dollars was declared as stock dividends.

Greene-Cananea—The May output was 3,916,000 lb. of copper, containing 84,600 oz. of silver and 509 oz. gold. This is slightly less than the April production.

Africa

RHODESIA

The gold output in April is reported at 52,906 oz. fine, being 4876 oz. more than in March, and making a total for the four months ended April 30 of 195,301 oz. By values, the total production for the four months was $3,915,550 in 1908, and $4,000,497 in 1909; an increase of $84,947, or 2.2 per cent.

Other production reported in April was 21,495 oz. silver, 4 tons copper, 82 tons lead, 1748 tons chrome ore and 28 tons asbestos. Coal production from the Warkie mines was 13,498 tons.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, June 9—Reports from the West continue to be encouraging. An increased business is being done in steam coal at nearly all the large centers. Mines are running on better time and making larger outputs, and there is decidedly a more hopeful feeling in the trade. Car supply throughout the West is generally good and coal is moved promptly.

In the East the bituminous trade is improving, though much more slowly than in Western territory. Still, there is an improvement and indications are that it will continue.

The anthracite trade is quiet and steady. Production has been cut down in April and during the present month, and in consequence accumulated stocks are being gradually worked off.

Lake Coal Trade—The question of rates to Lake Erie ports on coal for shipment to the Northwest is still unsettled. It is understood that the West Virginia operators will continue to fight against the proposed differential rates before the Interstate Commerce Commission and in the courts.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 29 short tons:

	1908.	1909.	Changes.
Anthracite	2,278,735	2,198,543	D. 80,192
Bituminous	13,154,336	14,352,766	I. 1,198,430
Coke	2,818,885	4,065,142	I. 1,246,257
Total	18,251,956	20,616,451	I. 2,364,495

Increase for the week, 181,498 tons. Total increase this year to date was 13 per cent.

The coal mined by the Monongahela River Consolidated Coal and Coke Company for the six months of its fiscal year ended April 30 was 3,254,055 tons in 1907-8, and 2,869,134 in 1908-9; decrease, 384,921 tons, or 11.8 per cent.

Anthracite coal shipments in May were 5,063,873 long tons, being 827,303 tons less than in April, and 1,268,501 tons less than in March. For the five months ended May 31 the shipments were, in long tons:

	1908.	1909.	Changes.
Reading	5,173,553	5,396,756	I. 223,203
Lehigh Valley	4,551,018	4,397,739	D. 153,279
N. J. Central	3,609,195	3,365,138	D. 244,057
Lackawanna	4,115,335	3,942,193	D. 173,142
Del. & Hudson	2,784,864	2,870,585	I. 85,721
Pennsylvania	2,619,655	2,566,269	D. 53,386
Erie	2,958,190	3,359,100	I. 400,910
N. Y., Ont. & West.	1,151,717	1,148,983	D. 2,734
Total	26,963,527	27,046,763	I. 83,236

Three companies showed increases and five decreases. The total gain this year was 0.3 per cent.

Coal tonnage originating on the Southern railway, three months ended March 31: Alabama district, 564,936; Tennessee district, 336,244; total, 901,280 short tons, an increase of 326,580 tons over last year.

New York

Anthracite

June 9—The anthracite trade is quiet and steady. Sales are about as usual at this time of the year. The collieries are beginning to run on a little better time as the stocks are being worked off.

There is no change in prices which are for prepared sizes, $4.45 for lump, and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor. For steam sizes current quotations are unchanged at $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice or buckwheat No. 2, and $1.25@1.50 for barley, f.o.b. New York harbor points.

Bituminous

The Seaboard bituminous trade is beginning to wake up and show some activity after its long rest. Mills and factories which have been scraping the boards in their coal bins are feeling the necessity of putting in more stocks. It is noticeable that many of the orders now received come with the request to ship as soon as possible.

The far East is doing best in the trade. The Sound is rather quiet. In New York harbor business is slow and the harbor is coming to be looked on as a dumping ground for cheap coal. The lower grades are selling at $2.40@2.50 per ton, f.o.b. shipping port, and better grades $2.50@2.60 and upward. The harbor docks are generally clear and there is no demurrage coal on the market.

All-rail trade is still improving and has now reached a fair basis. Car supply is good, but transportation is rather slow, dropping a little behind the schedule in many cases.

In the Coastwise trade small vessels are rather scarce, but large boats are plenty, and on the whole it is a shipper's market for tonnage and freights are low. For large vessels from Philadelphia quotations are 75@80c. to Lynn and Newburyport; 60@65c. to Boston, Saco and Portland; 45@50c. to Providence and the Sound. From New York rates are 60@65c. to points around Cape Cod.

There has been some inquiry for outside coal for the West Indies, but sailing vessels are reluctant to take business at this time of the year, being afraid of bad weather and hurricanes.

Birmingham

June 7—The coal trade in Alabama is dragging along. There is not much being done at the mines. The coming convention of the United Mine Workers of America, Alabama district No. 20, to start on June 14, is to be watched closely by the operators in this section. Reports have it that the officials of the union have been making an effort to reorganize the men and bring about more trouble. From the headquarters of the operators it is learned that there will never be any more recognition of the union miners in this State, so far as the larger operators go.

Coke is in steady demand with the production being held up well. A. Dempster, of Pittsburg, was re-elected president of the Corona Coal and Iron Company at a meeting held here last week. The Corona company has had a prosperous season, despite the dullness of the coal trade.

Chicago

June 7—Coal consumption is down to its normal summer level, to all appearances. There is a fair demand for fine steam coals; lump suffers from the drift of the market, the trade centering about Illinois and Indiana screenings. For steam lump and general domestic coals there is practically no market. Contract business has obtained most of the big consuming interests, at low figures. Run-of-mine is hard to sell.

Illinois and Indiana coals bring in car lots $1.55@2.25 for lump or egg; $1.65@1.75 for run-of-mine; $1.35@1.65 for screenings.

Eastern coals are slack. Smokeless run-of-mine is in too large supply and sells for $2.95@3.05, with lump at $3.20@3.25. Hocking is still too abundant, bringing 10c. or 25c. under the $3.15 list price. Youghiogheny continues even at $3.15 for ¾-in. coal and Pittsburg No. 8 is quiet at $2.65 for ¾-in. lump, the demand for both being light.

Anthracite sales are light, in both city and country.

Cleveland

June 8—Lake coal is moving more freely, the docks and yards being less crowded. The railroads, however, want

to see more improvement before they take coal for the Lake trade from the mines.

Local business shows improvement, and steam coal is being taken readily in quarters where buyers have been holding back. Slack is in best demand. No. 8 district brings $1.95@2.05 for lump; $1.70@1.80 for run-of-mine; $1.40 for slack, all f.o.b., Cleveland. Middle district runs about 10c. under these prices.

Indianapolis

June 7—In a general way the coal situation presents additional favorable features, but there is still room for a larger advance both in output and price. There is less heard of empty coal cars on the sidings, of the timidity of buyers, of the strike on the Lakes. Blast furnaces and mills continue to increase operations and these are regarded as hopeful signs and Indiana mines are beginning to profit by the increasing consumption for these and other purposes. There were more mines in operation during the past week than since last March and more men were employed. Two or three mines resumed operation after months of idleness and work is progressing on several shafts in new territory.

Pittsburg

June 8—The heavy rains of last week brought a good stage in the rivers, and about 5,000,000 bu. of coal have gone down this week. The coal market remains rather quiet. Nominal prices are continued at $1.10 to manufacturers and $1.20 to retail dealers, for mine-run at mines, these prices being shaded 5 to 10c. per ton. Slack is quoted at 60 to 65 cents.

Connellsville Coke—The positive statement is made on behalf of the promoters of the Connellsville coke merger that the parties back of the movement are interested in the consumption of coke and have business reasons for desiring to acquire the properties; but no direct statement can yet be obtained as to who are back of the purchase. The appraisers are at work. There are four options involving prices of $5000 an acre or higher, but these cover a relatively small acreage, and the promoters expect to be able to scale them down 20 per cent. The remainder of the options on Connellsville coal are claimed to run from $2200 to $2700 an acre. There are about 90,000 acres in the Connellsville region, of which the United States Steel Corporation controls 60,000 acres. Of the remaining 30,000 acres it is expected 20,000 acres will be purchased, while about 15,000 acres of Greene county coal will be taken, making 35,000 acres altogether to go into the merger, which will be capitalized at $60,000,000. The stock has all been underwritten, and while some of the sellers will be urged to take some stock in the new company it is represented that it is desired to have them in for the purpose of having practical coke operators interested.

The report is confirmed that the three-year contract between the Jones & Laughlin Steel Company and the Thompson-Connellsville Coke Company was at $2 per ton at ovens. A steel company has just taken 50,000 tons of coke for second half, at $1.60 at ovens, this being to supplement its own production. The market for Connellsville furnace coke remains at $1.50@1.60 for prompt and $1.60@1.80 for contract, according to grade. Foundry coke is $1.80@2 for prompt and $1.90@2.25 for contract, depending on grade.

The *Courier* reports production in the Connellsville regions for the week ended May 29 at 284,866 tons, a gain of 6000 tons. Shipments are: 3637 cars to Pittsburg district; 5595 cars to points west of Pittsburg; 739 cars to points east of Connellsville; total of 9971 cars, or 500 more than the preceding week.

Foreign Coal Trade

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 29: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.60; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.64; seconds, $2.46. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, June 9—The iron and steel markets continue generally active. New business just now is coming in perhaps in rather less volume than in May, but still in sufficient quantity to keep the mills active with fair prospects of remaining so for some time to come.

In pig iron, foundries generally are placing orders quite freely for the third quarter, and to some extent for the fourth quarter also. Buyers seem to be no longer feeling their way, but are ready to take on considerable stocks, evidently believing that they will be able to use them to advantage. Furnaces generally are firmer in their views and are asking at least 25c. more per ton than last month, generally with an advance of 50c. for fourth-quarter deliveries. Basic iron has been in strong demand and large sales have been made. Parallel with this is a call for heavy steel melting scrap, which is getting to be rather scarce and bringing good prices.

In finished material, structural steel continues in demand; while few large contracts have been placed, there have been many small orders making up a good volume of business. Bars have also been selling freely. In plates demand has improved owing to the placing in the East of several contracts for new ships for the coasting trade. The shipyard activity on the Atlantic coast promises to be greater during the coming season than for some years past.

Railroads have been ordering freely for new equipment. A recent estimate is that 950 locomotives and 21,500 cars have been ordered in the five months ending May 31. Rail orders are still light so far as standard sections are concerned, but light rails have sold quite freely and there is a good deal of trolley-rail business in sight. Some good contracts have already been placed.

Tinplate Wages—It is stated that the American Sheet and Tin Plate Company will make no agreement with the Amalgamated Association this year, but will run all its plants on the open-shop plan after the present agreement with the association expires.

Baltimore

June 7—Exports for the week included 3,271,760 lb. steel billets to Liverpool; 1396 tons steel rails to Bahia Blanca and 5137 tons to Guaymas, Mexico; 840,223 lb. pipe to Panama; 81,800 lb. tin scrap to Antwerp. Imports included 700 tons manganese ore from Germany and 350 tons from Cuba; 11,350 tons iron ore from Cuba; 4239 tons cupreous pyrites from Spain.

Birmingham

June 7—The month of June started off well with the Southern pig-iron manufacturers. There has been a steady inquiry for iron and the sales so far this month more than equal the make. No. 2 foundry is being held for $11.50 per ton, minimum, while $12 is being asked for third-quarter delivery and some sales being made. Three furnaces went out of blast during the past fortnight and one more will be cold within a few days. However, every preparation has been made for a resumption at two furnaces and two others will soon be in condition to resume operation. The home consumption continues to show improvement, the cast-iron pipe makers having large orders on hand and the machine shops and foundries receiving business right along. During the month of May the iron producers in Alabama sold more than their make. The make so far this month has been covered. The Ensley steel plant is still idle.

Chicago

June 7—Conditions in the iron and steel market remain indicative of a bright future but with business in pig iron still sluggish. The ordinary consumer is not yet buying for the future; he is awaiting developments of tariff, general market conditions and a host of other things. His purchases are small and for the next three months, as a rule. When he contracts into the last quarter it is also for small amounts. The large consumer—he who

buys in lots of 1000 tons or more—is equally cautious. Both sides—the selling and the buying—are awaiting developments.

Southern iron hovers about $11.50 Birmingham ($15.85 Chicago). Sales probably have been made—those most favorable to the seller—at 50c. below this price. On the other hand, some have been made at $12 Birmingham. What price a large order would bring is questionable. Northern iron holds to $16.50 base price for No. 2, with furnaces reported close to demands and producers still conservative. Lake Superior charcoal, with a tight market, brings $19.50.

Iron and steel products continue active. Coke finds a steady market at $4.70 (or $2.05 at the ovens) and the supply well regulated to the demand.

Cleveland

June 8—There has been more buying of iron ore, now that the price is established. The quotations are $4.50 for Old Range and $4.25 for Mesabi bessemers; $3.70 for Old Range and $3.50 for Mesabi non-bessemers, all f.o.b. Lake Erie ports. Guarantees are 55 per cent. iron on bessemer and 51.5 on non-bessemer ores. The strike is making some trouble still, but there are plenty of vessels moving.

Pig Iron—A good business is being done, with prices 25c. higher, the base being $15.25@$15.50 for No. 2 foundry.

Finished Material—New sales are a little slower, but deliveries on contracts are being urged. Plates are more in request, but business in bars is lively, and structural steel orders are still coming to the mills.

Philadelphia

June 9—The sum total of sales in eastern Pennsylvania for the past week falls below that of some previous like periods. The lack in sales was made up in inquiries. Prices quoted show a hardening, especially for basic, which promises to be called for in considerable quantities owing to recent favorable developments in the steel industry. Inquiries for low grades of pig iron are under consideration by one or two furnace companies. Electrical equipment manufacturers are in the market for special brands, the stocks of which are practically exhausted. The most significant feature of the situation is the practical absence of stocks of desirable irons. Forge iron continues to drag. Foundry is strong even in the absence of large sales. No. 2X is quoted at $16.50; forge, $15; basic, $15.50, with an upward tendency.

Steel Billets—Billets are decidedly stronger under heavy buying. Negotiations now in progress for large quantities.

Bars.—There is a larger demand for common iron especially. Mill owners are snatching up all the business they can get and are quoting 1.30c. delivered.

Sheets—Still further improvement is noticed in mill orders. The industry as a whole is gaining ground, though full capacity is not reported.

Pipes and Tubes—Liberal buying is in progress and prices are hardening.

Plates—A marked improvement in demand was developed within a few days. It is said an advance in early-delivery plates will be made.

Structural Material—A large volume of business has been placed at the mills and the daily receipt of inquiries is encouraging manufacturers. Prices are not advanced but a change is looked for in quotations.

Scrap—Heavy steel scrap is pretty well cleaned up and yardmen are on the warpath trying to fill new orders for steel mills. Light scrap is dull, except No. 1 yard. The large dealers are scurrying after stock and stronger prices will be the outcome.

Pittsburg

June 8—The iron and steel trade is in a healthy and prosperous condition. While the full capacity is not engaged, production is at a higher rate than at any time since October, 1907. Outside of railroad material, the shipments of the mills are fully up to the rate prevailing before the panic, and in some cases at a greater rate.

Production of pig iron has shown a steady gain since about the middle of April, but the gain is furnished altogether by the steel-works furnaces, the merchant furnaces not gaining any, but improving their position by ceasing the accumulation of stocks. Production of steel has shown a material increase. Many of the works are operating at absolutely full capacity.

Prices of finished steel products are substantially unchanged. There is a possibility of an early advance in wire products, possibly of $2 a ton, while a similar advance in merchant pipe about July 1 is not altogether improbable.

Pig Iron—The tone of the local market is still stronger, and there have been fairly large sales in basic, with moderate sales in bessemer, while foundry and forge grades have been relatively quiet. Bessemer is held at a minimum of $15, Valley, for prompt delivery, while most sellers are quoting $15.25 for extended delivery, and sales have been made at this price. The minimum of the market on recent sales was $14.50, Valley, this price being done both on prompt and on third-quarter delivery. Sales of basic aggregating possibly 10,000 tons have been made in the local market in the past week, at $14.25, $14.35 and $14.50, Valley, the market showing a sharply advancing tendency, the present position being that nothing below $14.50, Valley, can be done, some furnaces quoting $14.75 and some as high as $15. The latter have practically withdrawn from the market for the present. The bessemer and basic averages, compiled from actual sales, have been as follows, Valley furnace: January, $16.44 and $15.50; February, $15.88 and 15.19; March, $15.44 and $14.94; April, $14.90 and $14.15; May, $14.58 and $14.12. The May average on bessemer corresponds with the low point of last year, made in October. April and May made new low prices on basic.

Steel—The several sales of sheet-bars made lately at $24@25, delivered, for both prompt and second-half delivery, have attracted considerable attention, the official market being $25.50. It is evident that the outside steel mills are willing to support the independent sheet mills in their contest for business with the leading interest. Billets remain firm at $23, Pittsburg. The regular market on plates remains at 1.3c., especially attractive business being sometimes taken at 1.25 cents.

Sheets—Shading continues in sheets. The regular market is 2.20c. on black and 3.20c. on galvanized, 28 gage, Pittsburg, but these prices are sometimes shaded $1 a ton. Corrugated roofing is nominally $1.55 for painted and $2.80 for galvanized, per square, but these prices are shaded $2 a ton.

Ferromanganese—The market remains weak, $40.50 to $41, Baltimore, being quoted, equal to $42.45 to $42.95, Pittsburg.

Foreign Iron

Canadian Steel—The production of steel and of finished iron and steel in Canada for two years past was, in long tons:

	1907.	1908.	Changes.
Steel ingots.....	646,754	509,957	D. 136,797
Finished Material:			
Wrought iron.....	81,093	65,505	D. 15,588
Steel.....	519,086	431,012	D. 88,074
Total.....	600,179	496,517	D. 103,662

Of the steel made in 1908 there was 108,433 tons bessemer and 401,119 tons open-hearth steel. The ingots included 9657 tons direct castings. The largest item of finished material was 268,692 tons rails.

German Iron and Iron-ore Trade—Exports and imports of iron and steel, and of ores, in Germany, three months ended March 31, metric tons:

	Exports.	Imports.	Excess.
Pig iron.....	84,210	26,663	Exp. 57,547
Pig, 1908.....	66,223	60,983	Exp. 5,240
Other iron and steel.....	824,229	64,220	Exp. 760,009
Other iron, '08.	807,880	78,474	Exp. 729,406
Iron ore.....	641,784	1,764,323	Imp. 1,122,539
Iron ore, 1908..	921,985	1,348,103	Imp. 426,118
Manganese ore..	601	77,910	Imp. 77,309
Manganese, '08	440	91,735	Imp. 91,295
Slag and slag products.....	16,675	99,442	Imp. 82,767
Slag, 1908.....	16,373	118,278	Imp. 101,905

Iron ore includes pyrites residues, cinder and similar material.

Metal Markets

New York, June 9—The metal markets continue to show some improvement in demand and prices; also some speculative activity, especially in copper.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1909..	$ 3,349,107	$ 6,337,994	Exp. $ 2,988,887
" 1908..	2,561,197	14,476,341	Exp. 11,915,144
Year 1909..	44,316,626	15,507,382	Exp. 28,809,244
" 1908..	18,335,344	19,857,221	Imp. 1,521,877
Silver:			
Apri 1909..	4,952,251	4,073,504	Exp. 878,747
" 1908..	4,462,564	3,467,926	" 994,638
Year 1909..	19,426,181	14,526,722	" 4,899,459
" 1908..	17,048,851	14,298.582	" 2,750,269

Exports from the port of New York, week ended June 5: Gold, $2,120,440, chiefly to Paris and Buenos Aires; silver, $916,507, chiefly to London. Imports: Gold, $128,426; silver, $214,878, both principally from the West Indies and South America.

Gold—The demand for gold on the open market in London was not active and the Bank of England took most of the metal arriving.

Platinum—The market is rather weak and lower prices are not unexpected. Present quotations are $22.50@$23 per oz. for refined platinum, $25 for hard metal and $18@$20 for good scrap.

Our special correspondent writes from St. Petersburg, Russia, under date of May 27, that the markets are a little better, and the demand sensibly increases. Recently an offer to buy 20 poods of platinum at 18,000 rubles per pood was refused here by the Platinum Company, one of the great producers. Generally prices remain unchanged and the crude metal, 83 per cent., is quoted at Ekaterinburg 4.50 @5 rubles per zolotnik; in St. Petersburg, 18,000@19,000 rubles per pood—equal to an average of $17.86 and $18.13 per oz., respectively. These prices are nominal and subject to negotiation.

Silver—The market has settled into very narrow channels. Absorption of silver continues, but there does not seem to be much prospect of a rise of any material consequence soon.

SILVER AND STERLING EXCHANGE

June.	3	4	5	7	8	9
New York....	52¾	53	53¼	53	52¾	52⅞
London.....	24¼	24¼	24⅛	24⅛	24⅛	24⅛
Sterling Ex..	4.8785	4.8785	4.8790	4.8780	4.8775	4.8770

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, year to May 27:

	1908.	1909.	Changes.
India.....	£ 3,172,218	£2,161,200	D. £1,011,018
China.....	516,400	1,075,100	I. 558,700
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 3,778,818	£3,319,100	D. £ 459,718

Receipts for the week, £192,000 from New York; exports, £222,500 to India.

Copper, Tin, Lead and Zinc

June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
3	13⅛ @13⅜	13¼ @13½	60⅞	29¼	4.35	4.25 @4.30	5.12½ @5.15
4	13½ @13⅝	13¼ @13⅜	61¼	29¼	4.35	4.25 @4.30	5.15 @5.17½
5	13⅜ @13⅝	13⅜ @13½	....	29¼	4.35	4.25 @4.30	5.17½ @5.20
7	13⅝ @13¾	13⅜ @13½	61⅜	29¼	4.35	4.25 @4.30	5.20 @5.22½
8	13⅝ @13¾	13¾ @13⅝	61	29	4.35	4.25 @4.30	5.20 @5.25
9	13⅝ @13¾	13⅜ @13⅝	60⅜	29⅝	4.35	4.25 @4.30	5.20 @5.25

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands: special brands command a premium.

Copper—An outburst of speculative buying in all the European markets helped to carry the market forward further during the week. The business placed by consumers was of relatively small proportions. Toward the end of the week there was a realization of speculative holdings on a large scale, which tended to discourage new buying from that quarter, and the market closes barely steady at 13⅝@13¾c. for Lake copper; 13⅜@13⅝c. for electrolytic in ingots, cakes and wirebars; 13⅛@13⅜ for casting copper. The average of the week for casting copper has been 13⅛@13⅜ cents.

Copper sheets are 17c. base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire has been again advanced ¼c. to 15c. base, carload lots at mill.

The standard market in London, in which speculative activity centered, had advanced by Monday morning to the highest prices reached on this movement, and closing quotations of the first call on that day were cabled at £61 12s. 6d. for spot and £62 10s. for three months. Ever since there have been heavy realizing sales, which brought about a decline to £60 7s. 6d. for spot and £61 5s. for three months in the closing market of Wednesday.

For refined and manufactured sorts we quote: English tough, £65; best selected, £64@65; strong sheets, £76@78.

Tin—In sympathy with the advance in copper, the London market for tin has shown substantial strength throughout the week under review. Transactions increased considerably in volume on Wednesday, and reports are current that the bull party is engineering an advance. The market closes firm at £134 for spot and £135 7s. 6d. for three months.

The domestic market has been dull, the only exception being on Tuesday when some spot material was thrown on the market at somewhat below import prices. Future deliveries, however, were held at a premium, and the market closes at about 29⅝ cents.

Lead—The market is unchanged at 4.25 @4.30c. St. Louis, and 4.35c. New York.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 9, that lead is strong at the latest advance, and is salable at 4.32½@4.35c. for Missouri brands.

The London market has been holding its own, and closes steady at £13 3s. 9d. for Spanish and £13 6s. 3d. for English.

Spelter—In spite of the higher prices which have ruled of late, the production of this metal has not increased and it is generally recognized that the current output is not equal to the demand. Stocks are decreasing steadily on the one hand, while the consumption is expanding. During the week, heavy orders were again placed, particularly by the galvanizing industry, and the market advanced from day to day reaching at the close 5.20@5.25c. St. Louis, 5.35@5.40c. New York.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 9, that spelter is firm and active. The latest sales are on a basis of 5.30@5.32½ cents.

New York quotations for spelter June 3 were 5.27½@5.30c.; June 4, 5.30@5.32½c.; June 5, 5.32½@5.35c.; June 7, 5.35@5.37½c.; June 8 and 9, 5.35@5.40 cents.

The London market is unchanged at £22 2s. 6d. for good ordinaries, £22 7s. 6d. for specials.

Base price of sheet zinc is 6¼c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—Business is waiting for some decision on the tariff. In the absence of sales quotations are nominally unchanged at 8⅜c. per lb. for Cookson's; 7⅞c. for U. S.; 7⅜@7⅝c. for outside brands.

Aluminum—Prices remain at 22@24c. base for No. 1 ingots; 31@32c. base for wire; 33@34c. base for sheets. Business is not especially active.

Cadmium—Current quotations 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Paul Speier writes us from Breslau, Germany, under date of May 29, that the price of cadmium, which in 1907 was 1500 marks per 100 kg., fell in 1908 to 575 marks. This year there has been a further drop, prices for metal guaranteed 99.5 per cent., being 450@475 marks per 100 lb.—average, 50c. per lb. These are the lowest prices ever made.

Quicksilver—New York prices are still unchanged at $44.50 per flask of 75 lb. Sales have been light. San Francisco quotations are $44 for domestic orders and $42 for export. The London quotation is £8 7s. 6d. per flask, but as low as £8 2s. 6d. is named by second hands.

Nickel—Large lots, contract business, 40@50c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots, The price for electrolytic is 5c. higher.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

German Metal Imports and Exports

Imports and exports of metals—other than iron—in Germany, quarter ended March 31, in metric tons:

	Imports.	Exports.	Excess.	
Copper	39,131	15,298	Imp.	23,833
Copper, 1908	48,773	18,515	Imp.	30,258
Tin	3,301	1,610	Imp.	1,691
Tin, 1908	3,917	1,363	Imp.	2,554
Lead	16,930	7,677	Imp.	9,253
Lead, 1908	15,844	10,575	Imp.	5,269
Zinc	7,310	23,549	Exp.	16,239
Zinc, 1908	7,255	18,612	Exp.	11,357
Nickel	380	504	Exp.	124
Nickel, 1908	651	524	Imp.	127
Aluminum	410	1,388	Exp.	978
Aluminum, '08.	267	613	Exp.	346
Miscellaneous	337	2,398	Exp.	2,061
Miscellan's, '08	263	2,465	Exp.	2,202

The figures include alloys and manufactures of the several metals. Imports and exports of ores—other than iron—for the three months, were, in metric tons:

	Imports.	Exports.	Excess.	
Gold ore	23	.....	Imp.	23
Gold ore, 1908	7	.....	Imp.	7
Silver ore	372	.....	Imp.	372
Silver ore, '08	469	.....	Imp.	469
Copper ore	3,757	1,819	Imp.	1,938
Copp'r ore, '08	4,397	7,680	Exp.	3,283
Tin ore	2,779	4	Imp.	2,775
Tin ore, 1908.	2,307	21	Imp.	2,286
Lead ore	25,424	430	Imp.	24,994
Lead ore, '08	30,559	186	Imp.	30,373
Zinc ore	36,855	6,702	Imp.	30,153
Zinc ore, 1908	40,384	5,330	Imp.	35,054
Nickel ore	2,027	.....	Imp.	2,027
Nickel ore, '08	4,875	.....	Imp.	4,875
Miscellaneous.	1,038	103	Imp.	935
Mis., 1908	1,470	109	Imp.	1,361

Imports of chrome ore was 6474 tons, an increase of 4097 tons. Imports of pyrites were 143,357 tons in 1908, and 108,123 tons in 1909; exports 3924 and 2396 tons for the respective years. Miscellaneous ores include uranium, molybdenum, tungsten and other minor metals, with some mixed or complex ores.

Zinc and Lead Ore Markets

Joplin, Mo., June 5—The highest price paid was $46 per ton, the assay base price ranged from $43.50 down to $42 base for heads and as low as $40 base for slimes of zinc sulphide. The average price, all grades, was $39.56. An effort early in the week to lower the level of prices was met by an almost unanimous refusal to sell, and on Thursday the market was restored to a level of the previous week, for the higher base, while the low base was advanced. The highest price paid for lead was $60 per ton for 250 tons. As much more was sold at $59, but the bulk of the shipment was at $58 per ton, with a considerable tonnage of ore off grade selling at a price which lowered the average to $57.20, all grades.

SHIPMENTS, WEEK ENDED JUNE 5.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,453,100	1,008,690	$99,676
Joplin	2,247,530	162,260	52,088
Galena	747,400	57,280	16,982
Prosperity	255,470	276,390	13,277
Alba-Neck	481,140	57,930	11,782
Duenweg	475,640	95,760	11,438
Miami	359,120	169,950	10,335
Granby	566,320	13,300	8,676
Aurora	509,310	.....	7,732
Carthage	341,700	.....	7,175
Badger-Peacock	268,270	.....	5,633
Spurgeon	208,700	79,440	5,606
Oronogo	206,850	3,020	4,725
Sarcoxie	169,930	.....	3,483
Quapaw	146,650	2,280	2,925
Zincite	94,440	.....	1,936
Totals	10,531,570	1,926,300	$263,472
23 weeks	259,893,330	42,023,810	$5,854,712

Zinc value, the week, $208,368; 23 weeks, $4,736,374
Lead value, the week, 55,104; 23 weeks, 1,118,338

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	40.06	33.39	37.42	56.05	56.59
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., June 5—The highest price paid this week for zinc ore was $42.50; the base price of 60 per cent. zinc was $42 per ton. The highest price paid for lead ore was $58.50; the base price of 80 per cent. lead was $56@57 per ton.

SHIPMENTS, WEEK ENDED JUNE 5.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Strawbridge	960,000	.....	.....
Platteville	633,940	.....	227,500
Hazel Green	533,300	.....	.....
Benton	488,860	56,340	.....
Cuba City	347,240	94,955	.....
Linden	127,530	57,470	.....
Rewey	120,800	.....	.....
Harker	100,860	.....	.....
Galena	88,000	.....	.....
Livingston	80,000	.....	.....
Total	3,480,530	208,765	227,500
Year to June 5	51,280,809	2,316,480	4,145,500

In addition to the above there was shipped to the American Zinc Ore Separating Company—from Platteville 216,000 lb.; Linden 50,070 lb.; Rewey, 59,900 lb.—325,970 lb. and to the Joplin Separator Works, 153,900 lb. zinc concentrates.

There was shipped last week, not then reported, from Highland 192,400 lb.; from Linden, 125,490 lb.; from Harker, 228,660 lb. zinc ore. From Highland, 106,080 lb.; and from Harker, 51,600 lb. lead ore.

Chemicals

New York, June 9—The principal activity is in contract deliveries. New orders are not coming in freely in most lines.

Copper Sulphate—Quotations remain at $4.25 per 100 lb. in carload lots and $4.50 per 100 lb. in smaller parcels. Business is quiet.

Arsenic—A fair amount of trading has been recorded. Prices are 2⅞@3c. per lb. for white arsenic.

Nitrate of Soda—The market is firm and sales good at last quoted prices, 2.25c. for spot nitrate and 2.12½c. for futures.

Mining Stocks

New York, June 9—The general stock market has faltered a little in its upward course. The bull movement which was started last week has been interrupted by one or two days of reaction and in some stocks there was a good deal of liquidation and consequent lower prices. The indications are that this is only a temporary condition, and most operators are looking for higher prices again. At the close the tendency is rather uncertain.

A good deal of interest is being shown in the arrangement for listing Steel Corporation stocks on the Paris Bourse. There is much curiosity to see how this attempt to give Steel securities a wider market will succeed. On this market they remain very strong.

There was one sale of Homestake of South Dakota during the week at $91.50 per share for a small lot.

On the Curb the copper stocks were active but rather irregular in price. The Curb had its reaction also which carried down some shares, but left others untouched. The Nevada gold stocks are holding their own better. Cobalt stocks are in demand, and interest in them is being worked up in every possible way.

Boston, June 8—Outside of a sensational drop in Mass mining stock there have been no alarming developments in the local market. This stock was bulled to $18.25 a week ago and had a rapid decline to $8.50, the interval between these extreme prices being only three days. The finding of a new orebody some months ago was the cause for bulling the stock from around $6 to the high price mentioned above. A mill run of about 600 lb. of rock from this new vein yielded considerably less than 1 per cent. copper, which was disappointing and the cause of the subsequent break. A rally to $10 followed, but the price today was close to $9.

Sentiment on copper shares is very optimistic, and today's market showed a material broadening tendency.

North Butte had a $5 bulge today to above $61.75. The bear selling seems to

be at an end. Copper Range displayed good rallying power, advancing to above $83. Old Dominion rose $2 to $57.50, and Shannon touched $17. Stockholders of this company have authorized the directors to guarantee the principal and interest on $600,000 in 6-per cent. 10-year bonds to be issued by the Shannon-Arizona railway, convertible into Shannon Copper stock at $20 per share. They have also authorized an increase of 30,000 shares of Shannon stock for the exchange. These bonds are being offered to Shannon stockholders, of record June 15, in the proportion of one $1000 bond for 500 shares of stock. Shannon rights sold up to 30c. today.

North Lake mining attracted considerable attention by its $1.75 advance to $10.75. Advices state that the drill at No. 3 hole encountered copper.

The declaration of the regular quarterly dividend of 50c. by the Utah Consolidated had a stimulating effect, causing the stock to stiffen to $44.

Curb trading has been in the better class of stocks. Outside of sharp breaks in Davis-Daly and Ohio Copper there were no particular features.

Salt Lake City, June 24—During the month of May, 3,045,395 shares of stock sold for $2,123,162 on the Salt Lake Mining and Stock Exchange. The market was a broad one and holders of stock had no trouble in making sales. The feature of the month's trading was a slump in Iron Blossom, which declined after many heavy sales.

STOCK QUOTATIONS

NEW YORK	June 9
Name of Comp.	Clg.
Alaska Mine	.50
Amalgamated	86¼
Anaconda	50⅞
Balaklala	‡2 1/16
British Col. Cop.	8
Buffalo Mines	‡3½
Butte Coalition	27¼
Colonial Silver	5/16
Cum. Ely Mining	8½
Davis-Daly	5½
Dominion Cop.	‡.07
Douglas Copper	3¾
El Rayo	2
Florence	3⅜
Foster Cobalt	.32
Furnace Creek	.10
Giroux	7⅛
Gold Hill	⅛
Goldfield Con.	7¾
Granby	106½
Greene Gold	½
Greene G. & S.	9
Guanajuato	1⅝
Guggen. Exp.	200
Hanapah	.15
Kerr Lake	7⅞
McKinley Dar.	.98
Miami Copper	15
Micmac	¾
Mines Co. of Am.	⅝
Mitchell Mining	‡¾
Mont. Sho. C.	‡1 3/16
Nev. Utah M. & S.	2 7/16
Newhouse M. & S.	2
Nipissing Mines	10¾
Old Hundred	‡½
Silver Queen	.37
Stewart	9/16
Tennessee Cop'r.	41½
Tri-Bullion	¾
Union Copper	1
Utah Apex	6½
Utah Copper	52
Yukon Gold	4⅞

*Ex. Div. †Ex. Rights.

BOSTON	June 9
Name of Comp.	Clg.
Adventure	8½
Allouez	42½
Am. Zinc	25⅞
Arcadian	5
Arizona Com.	42¼
Atlantic	9¾
Boston Con.	16
Calumet & Ariz*.	109
Calumet & Hecla.	675
Centennial	34
Copper Range*	82½
Daly-West	‡7½
East Butte	14
Franklin	16¼
Greene—Can.	10¾
Hancock	‡12
Isle Royal	28¼
Keweenaw	5
La Salle	13¾
Mass.	9¼
Michigan	10¼
Mohawk	67½
Nevada	22½
North Butte	56½
Ojibway	12¼
Old Colony	‡.60
Old Dominion*	56¾
Osceola	140
Parrot	35
Quincy	93
Rhode Island	14¾
Shannon	17
Superior	41½
Superior & Bost.	16¾
Superior & Pitts.	14¾
Tamarack	‡72
Trinity	13
U. S. Smg. & Ref.	50¼
U.S. Sm. & Re., pd.	49¾
Utah Con.	43½
Victoria	5
Winona	6
Wolverine	‡148
Wyandotte	3½

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	43¾
Am. Smelt. & Ref.	96
Am. Sm. & Ref., pf.	112½
Colo. Fuel & Iron	43½
Federal M. & S., pf.	90
National Lead	87¾
National Lead, pf.	108½
Pittsburg Coal	‡12¼
Republic I. & S.	32⅝
Republic I. & S., pf.	106¾
Sloss-Sheffield	83½
Standard Oil	676
U. S. Steel	67¾
U. S. Steel, pf.	125¼
Va. Car. Chem.	51¼

BOSTON CURB	Low.
Ahmeek	169
Black Mt.	1
Chemung	16⅞
Globe Con.	4⅜
Helvetia	5⅝
North Lake	‡7½
Ray Central	3 1/16
Ray Con.	17
San Antonio	11

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	June 5	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.08	.05
Center Cr'k	1.85	1.50
Cent. C. & C.	81.00	80.00
C. C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.35	.30
St. Joe	12.00	11.00

LONDON	June 9
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton's Il. d.	0 3 1½
Camp Bird	1 5 3
Esperanza	2 18 9
Tomboy	1 2 6
El Oro	1 6 3
Oroville	0 13 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. June 9.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.50
Best & Belcher	.35
Caledonia	.09
Challar	.06
Comstock	.31
Con. Cal. & Va.	.66
Crown Point	.50
Exchequer	.25
Gould & Curry	.08
Hale & Norcross	.20
Mexican	.79
Ophir	1.20
Overman	.14
Potosi	.13
Savage	.19
Sierra Nevada	.28
Union	.31
Utah	.04
Yellow Jacket	.56
TONOPAH STOCKS	
Belmont	.78
Extension	.46
Golden Anchor	...
Jim Butler	.13
MacNamara	.22
Midway	.22
Montana	.67
North Star	.02
Tono'h Mine of N.	7.12½
West End Con.	.27
GOLDFI'D STOCKS	
Adams	.01
Atlanta	.14
Blue Bell	.03
Booth	.13
Columbia Mt.	.10
Comb. Frac.	.59
Con. Red Top	.01
Cracker Jack	.02
Dia'dfield B. B. C.	.04
Goldfield Belmont	.04
Goldfield Daisy	.32
Great Bend	.08
Jumbo Extension	.10
Kendall	.05
Lone Star	.04
May Queen	.04
Oro	.07
Red Hill	.08
Roanoke	...
Sandstorm	.08

Name of Comp.	Clg.
Silver Pick	.12
St. Ives	.10
Triangle	.01½
BULLFROG STOCKS	
Gibraltar	03
Homestake King.	.01
Mont. Shoshone C.	1.62½
Tramp Cons.	.05
MISCELLANEOUS	
Bonnie Clare	...
Lee Gold Grotto	...
Nevada Hills	.87½
Nevada Smelting.	1.00
Nevada Wonder	.50
Nevada-Utah	2 37½
Penn-Wyoming	04
Pittsburgh S. Pk.	.50
Rawhide Caol't'n.	..
Round Mt. Sphinx	10

COLO. SPRINGS	June 4
Name of Comp.	Clg.
Acacia	.07
Black Bell	....
C. C. Con.	‡.03½
Dante	.06½
Doctor	.08
Elkton	.63
El Paso	.50
Findlay	‡.15
Gold Dollar	‡.11½
Gold Sovereign	.03½
Isabella	.22
Jack Pot	.06¾
Jennie Sample	‡.07
Jerry Johnson	.06¼
Mary McKinney	.39½
Pharmacist	.03⅛
Portland	.90
Un. Gold Mines	.05½
Vindicator	.60
Work	.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Wing, Ida	May 8	June 5	$0.005
Bullion, Nev.	June 14	July 13	0.05
Challenge Con., Nev	June 22	July 13	0.05
Chollar, Nev.	June 8	June 30	0.10
Confidence, Nev.	May 18	June 8	0.20
Con. Imperial, Nev.	May 26	June 17	0.01
Dalton M. & M., Utah	May 26	June 9	0.00½
Echo, Ida.	May 1	June 1	0.002
Exchequer, Nev.	May 5	May 26	0.05
Gould & Curry, Nev.	June 8	June 26	0.10
Hecla M. & M., Utah	May 15	June 14	0.05
Julia Con., Nev.	May 24	June 17	0.03
Mexican, Nev	June 28	July 14	0.10
Nev. Superior	Apr. 10	May 1	0.075
Palmyra G. & C., Utah	June 11	June 30	0.001
Paymaster, Utah	June 12	June 30	0.00½
Reindeer C. & G., Ida.	Apr. 28	May 28	0.005
Scorpion, Nev.	June 14	July 6	0.02
Sierra Nevada, Nev.	May 4	May 25	0.10
Uintah Treas. Hill, Utah	May 20	June 9	0.01
Union Con., Nev.	June 28	July 19	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56¼	12.928	12.93¾	58.331	57.363
May	12.598	12.893	12.788	13.228	57.387	59.338
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	29.225	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	13.225
June	4.466	.....	.....	12.600	....
July	4.744	.....	.....	13.000	....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.975
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.